

How I Increased My Salary More Than 300%

By JOSEPH ANDERSON

I AM just the average man—twenty-eight years old, with a wife and a three-year-old youngster. I left school when I was fourteen. My parents didn't want me to do it, but I thought I knew more than they did.

I can see my father now, standing before me, pleading, threatening, coaxing me to keep on with my schooling. With tears in his eyes he told me how he had been a failure all his life because of lack of education—that the untrained man is always forced to work for small salary—that he had hoped, yes, and prayed, that I would be a more successful man than he was.

But no! My mind was made up. I had been offered a job at nine dollars a week and I was going to take it.

That nine dollars looked awfully big to me. I didn't realize then, nor for years afterward, that I was being paid only for the work of my hands. My brain didn't count.

The Story of a Man Just Like Myself

THEN one day, glancing through a magazine, I came across the story of a man just like myself. He, too, had left school when he was fourteen years of age, and had worked for years at a small salary. But he was ambitious. He decided that he would get out of the rut by training himself to become expert in some line of work.

So he got in touch with the International Correspondence Schools at Scranton and started to study in his spare time at home. It was the turn in the road for him—the beginning of his success.

Most stories like that tell of the presidents of great institutions who are earning \$25,000 and \$50,000 a year. Those stories frighten me. I don't think I could ever earn that much. But this story told of a man who, through spare-time study, lifted himself from \$25 to \$75 a week. It made an impression on me because it talked in terms I could understand. It seemed reasonable to suppose that I could do as well.

I tell you it didn't take me long that time to mark and send in that familiar coupon. Information regarding the Course I had marked came back by return mail. I found it wasn't too late to make up the education I had denied myself as a boy.

It Was All So Easy, Too!

I WAS surprised to find out how fascinating a home-study course could be. The I. C. S. worked with me every hour I had to spare. I felt myself growing. I knew there was a bigger job waiting for me somewhere.

Four months after I enrolled my employer came to me and told me that he always gave preference to men who studied their jobs—and that my next salary envelope would show how much he thought of the improvement in my work.

Today, my salary is more than 300% greater than it was when I began my studies. That increase has meant a better home and all the luxuries that make life worth while.

What I have done, you can do. For I am just an average man. I had no more education to begin with than you have—perhaps not as much. The only difference is a matter of training. Yes, a matter of training.



How much longer are *you* going to wait before taking the step that will bring you advancement and more money?

Are You Earning Less Than \$75 a Week?

TO every man who is earning less than \$75 a week, I say simply this:—*Find out what the I. C. S. can do for you!*

It will take only a minute to mark and mail the coupon. But that one simple act may change your whole life.

If I hadn't taken that first step four years ago I wouldn't be writing this message to you today! No, and I wouldn't be earning anywhere near \$75 a week, either!

----- TEAR OUT HERE -----
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Without cost or obligation please explain how I can qualify for the position or in the subject before which I have marked an X in the list below:

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Popular Science Monthly

SEPT., 1921
Volume 99-No. 3

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225 West Thirty-ninth St. New York City



An Amazingly Easy Way to Earn \$10,000 a Year

Let Me Show You How Free

To the average man the \$10,000 a year job is only a dream. Yet today there are a surprising number of men earning five figure salaries who were merely dreaming of them a short while ago. The secret of their success should prove a startling revelation to every ambitious man who has ever aspired to get into the \$10,000 a year class.

There is nothing fundamentally "different" about the man whose salary runs into five figures. He is made of the same stuff as you and I. It is not necessary that he must enjoy the privilege of some influential connection or "pull." For example take J. P. Overstreet, of Dallas, Texas. A few short years ago he was a police officer earning less than \$1,000 a year. To-day his earnings are in excess of \$1,000 a month—more than \$12,000 a year. C. W. Campbell, Greensburg, Pa., was formerly a railroad employee on a small salary—last month his earnings were \$1,562.

Why Salesmen Earn Such Big Pay

Just stop a moment and think over the successful men of your acquaintance. How many of them are connected with some form of selling? If you will study any business organization you will see that the big jobs go to the men who sell, for upon their efforts depend the profits a company makes. Without trained men to place a product on the market, the finest goods are worth no more than so much clay. Salesmen are the very nerve centers of a business. Is it any wonder that they earn big pay?

The man who starts working as a bookkeeper or clerk for \$25.00 a week, never increases his value to the firm. Any advance in pay is merely a reward for length of service. At the end of ten years he is no more essential to the life of the organization than he was at the end of ten weeks. He is only a necessary liability—drawing his pay because somebody must be found to work at the unimportant, routine jobs. Once established in the rut, he becomes a cog in the machine—when he is worn out, he can be easily and cheaply replaced.

Why Don't You Get Into the Selling Field?

Mr. Overstreet, Mr. Campbell and the others whose letters you see on this page are all successful salesmen. They realized their ambitions by landing \$10,000 jobs in an amazingly simple way, with the help and guidance of the National Salesmen's Training Association. Sometime—somewhere back in the past, each one of them read of this remarkable course of Salesmanship training and Employment Service just as you are reading of it to-day. Each one of them was dissatisfied with his earning capacity—as perhaps you are—and each one cast his lot with the N. S. T. A. To-day they are important factors in the business world—enjoying all the comforts and luxuries money can buy. And yet they are not exceptions, for there are thousands of N. S. T. A. trained salesmen who are making big money, as we will be only too glad to show you if you will mail the coupon.

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I had never earned more than \$60 a month. Last week I cleared \$306 and this week \$218. You have done wonders for me.—Geo. W. Kearns, 107 W. Park Place, Oklahoma City, Okla.

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Earns \$1,562 in Thirty Days

My earnings for the past thirty days are \$1,562, and I won Second Prize in March although I only worked two weeks during that month.—C. W. Campbell, Greensburg, Pa.

Earned \$1,800 in Six Weeks

As soon as I received a letter from you and your literature, I knew that I was on the right track and very soon after I applied for a position as a Salesman to one of the firms whom you informed me were in need of a Salesman and to whom you had recommended me. As soon as they received my application, which was by mail, they wired me to come for an appointment which I did, with the result being that I sold my services to them in about thirty minutes, took a territory in Illinois and Wisconsin and made a success of it from the very first week.

From that time on I have been what might be termed as a "high pressure" Salesman, selling lines where nine out of ten Order Takers would fail. I have sold goods in a highly successful manner in nine or ten States, both North and South. My earnings for March were over \$1,000 and over \$1,800 for the last six weeks, while last week my earnings were \$356.00. I travel eleven months out of the year, working five days each week.

The N. S. T. A. dug me out of a rut where I was earning less than \$1,000 a year and showed me how to make a success.—J. P. Overstreet, Dallas, Texas.

in your spare time without making it necessary to give up your present position until you are ready to begin actual selling.

In addition to this remarkably efficient course of training, the N. S. T. A. maintains a Free Employment Service to help its Members to jobs in the lines for which they are best suited. This in itself is of incalculable value for it allows the prospective salesman to make a complete survey of the selling field and to select the work which most appeals to him.

Salesmen Are Needed—Now!

Get out of that rut! Work for yourself! Salesmanship is the biggest paid of all professions. Just because you have never sold anything is no sign that you can't. We have made Star Salesmen of men from all walks of life, with no previous selling experience. These men have jumped from small pay jobs to big selling positions and handsome incomes. The same training on which they founded their success is open to you. You can follow in their footsteps. Why don't you get in a class with men who make real money? Never before have the opportunities been greater. At least you cannot afford not to investigate the great field of Selling and see what it offers you. It will only cost you a 2 cent stamp and the facts and proof you will receive will surprise you.

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Dept. 15-M Chicago, Ill., U. S. A.

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Please send me, without any obligation on my part, your free Book, "A Knight of the Grip," and full information about the N. S. T. A. system of Salesmanship training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name.....

Street.....

City.....

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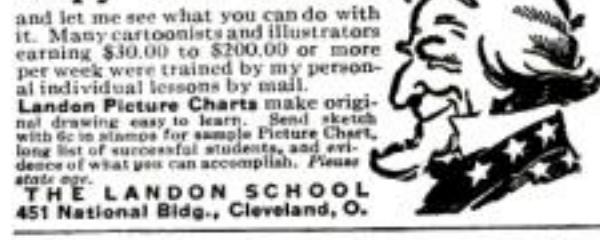
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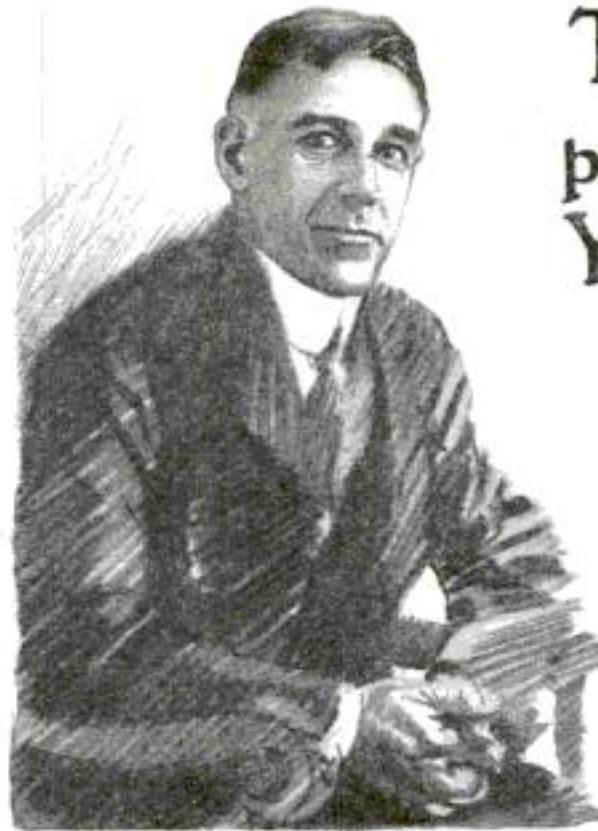
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P.S.M.—9-21

NERVOUS AMERICANS

By Paul von Boeckmann

Lecturer and Author of numerous books and treatises on Mental and Physical Energy, Respiration, Psychology, and Nerve Culture

We are the most "high strung" people on Earth. The average American is a bundle of nerves, ever ready to spring into action, mentally and physically. The restless energy of Americans is proverbial.

We may well be proud of our alert, active and sensitive nerves, as it indicates the highest state of civilization, courage, ambition and force of character, but this high nerve tension has not been without its grave dangers and serious consequences. Neurologists agree that we are more subject to nervous disorders than any other nation. Our "Mile a Minute Life" is tearing our nerves to shreds and we are deteriorating into a nation of Neurasthenics.

Since the Nervous System generates the mysterious power we term Nerve Force, that controls and gives life and energy to every muscle, every vital organ, every drop of blood and cell of the body, nerve exhaustion necessarily must result in a long train of ailments and weaknesses.

The noted British authority on the nerves, Alfred T. Schofield, says: "It is my belief that the greatest single factor in the maintenance of health is that the nerves should be in order."

How often do we hear of people running from doctor to doctor, seeking relief from a mysterious "something-the-matter" with them, though repeated examinations fail to indicate that any particular organ is weak or diseased. In nearly every case it is Nerve Exhaustion—Lack of Nerve Force.

The symptoms of nerve exhaustion vary according to individual characteristics, but the development is usually as follows:

FIRST STAGE: Lack of energy and endurance; that "tired feeling," especially in the back and knees.

SECOND STAGE: Nervousness; sleeplessness; irritability; decline in sex force; loss of hair; nervous indigestion; sour stomach; gas in bowels; constipation; irregular heart; poor memory; lack of mental endurance; dizziness; headaches; backaches; neuritis; rheumatism, and other pains.

THIRD STAGE: Serious mental disturbances; fear; undue worry; melancholia; dangerous organic disturbances; suicidal tendencies, and, in extreme cases, insanity.

If only a few of the symptoms mentioned apply to you, especially those indicating mental instability, you may be sure your nerves are at fault—that you have exhausted your Nerve Force.

Nerve Force is the most precious gift of Nature. It means everything—your happiness, your health, your success in life. You should know all there is to learn about your nerves—how to relax, calm and soothe your nerves, so that after a severe nerve strain you can rebuild your lost Nerve Force, and keep yourself physically and mentally fit.

I have written a 64-page book which is pronounced by students of the subject to be the most valuable and practical work ever written on nerve culture. The title of the

book is "Nerve Force." It teaches how to soothe, calm and care for the nerves. The cost is only 25 cents (coin or stamps). Address Paul von Boeckmann, Studio No. 162, 110 West 40th St., New York.

The only way to judge the value of this book is to read it, which you may do at my risk. In other words, if after applying the advice given in this book it does not meet your fullest expectations, I shall return your money, plus the outlay of postage you may have incurred. I have advertised my various books on health, breathing and other subjects in this and other magazines for more than 20 years, which is ample evidence of my responsibility and integrity. Over a million copies have been sold.

You should send for this book to-day. It is for you whether you have had trouble with your nerves or not. Your nerves are the most precious possession you have. Through them you experience all that makes life worth living; for to be dull nerved means to be dull brained, insensible to the higher phases of life—love, moral courage, ambition and temperament. The finer your brain is, the finer and more delicate is your nervous system, and the more imperative it is that you care for your nerves. The book is especially important to those who have "high strung" nerves and those who must tax their nerves to the limit. The following are extracts from letters from people who have read the book and were greatly benefited by the teachings set forth therein.

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

"Your book did more for me for indigestion than two courses in dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have reread your book at least ten times."

A woman writes: "Your book has helped my nerves wonderfully. I am sleeping so well and in the morning I feel so rested."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

A physician says: "Your book shows you have a scientific and profound knowledge of the nerves and nervous people. I am recommending your book to my patients."

A prominent lawyer in Ansonia, Conn., says: "Your book saved me from a nervous collapse, such as I had three years ago. I now sleep soundly and am gaining weight. I can again do a real day's work."

Publisher's Note: Prof. von Boeckmann is the scientist who explained the nature of the mysterious Psycho-physic Force involved in the Coulon-Abbott Feats; a problem that had baffled the leading scientists of America and Europe for more than thirty years, and a full account of which has been published in the March and April issues of Physical Culture Magazine.

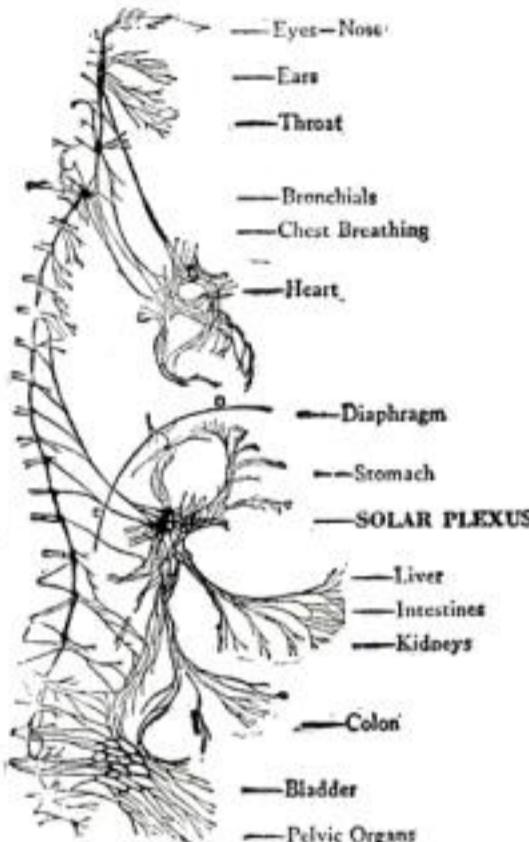


Diagram showing the location of the Solar Plexus, known as the "abdominal brain," the great center of the Sympathetic (Internal) Nervous System. Mental strains, especially grief, fear, worry and anxiety, paralyse the Solar Plexus, which in turn causes poor blood circulation, shallow breathing, indigestion, constipation, etc. This in turn clogs the blood with poisons that weaken and irritate the nerves. Thus Mental strain starts a circle of evils that cause endless misery, aches, pains, illness, weaknesses and generally lower mental and physical efficiency.

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- 5—"79 replies, 18 orders, one issue."
- 6—"Your readers are Buyers."
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- 8—"Ran ad December—orders all summer."
- 9—"Cost \$34.80—produced \$245."
- 10—"It brings home the bacon."

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FOR THE HOME

GRANDFATHER clock works, \$5.00. Build your own case, instructions free; make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Nicetown, Pennsylvania.

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AN excellent opportunity for industrious men to enter this field of Metal Toys and Novelties. Manufacturers wanted for large production and Homeworkers on smaller scale to manufacture Toy Soldiers, Wild Animals, Whistles, Bird-Whistles, Race Horses, Wagtail Pups, Cowboys, Indians, Cannons, Machine Guns, Religious Statues, Souvenirs, Trade Boosters and other lines. Hundred and more made complete per hour. Bronze Castingforms, complete outfit from \$5.00 up. No experience or tools needed. We buy these goods all year. High prices offered for painted goods. Large Contracts placed with manufacturers. An unlimited business open for energetic men. Correspondence invited only, if you mean real business. Illustrated Catalog and Booklet mailed free. Metal Toy and Novelty Mfg. Company, 1696 Boston Road, New York City.

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STAMMERERS: My simple and natural method will correct your impediment. Instruction individual. Samuel E. Robbins, 246 Huntington Avenue, Boston.

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IMITATION Money for advertising; samples; stage money 30c 100. Federal Book Co., 642 D Northeast, Washington, D. C.

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ALL makes, \$15.00 up; fifteen days' free trial. Catalogue mailed on request. Henry Typewriter Company, 217 West 125th Street, New York City.

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BE a Finger Print Expert. New book just published, "Finger Prints Simplified," by James Holt, Leavenworth, Kan. Describes and illustrates making, reading, classification, filing and comparing of finger prints; with questions and answers. Complete in every detail; fully illustrated. Postpaid, \$2.00. F. J. Drake & Co., 1003 Michigan Ave., Chicago.

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Two handsomely finished charts containing twenty-one large, beautifully produced pictures of myself showing every detail as to how to perform the movements with absolute correctness. The instructions are "straight from the shoulder" such as only an expert who went thru the mill himself could ever possibly produce.

In addition to the above you have the privilege to ask any questions pertaining to your physical training and to these I will gladly write a personal reply. This feature alone is a mighty valuable one as I give you the benefit of my many years of experience and you will find it worth much more than the price paid for the full course.

The Subjects of This Course Are of Tremendous Interests to Everyone

How to quickly make respond the inactive bowels—easily correct the rounded shoulders—in no time expel the bothering gas out of the stomach—promptly chase away the staleness of the body—strengthen the nerves and internal organs—easily overcome the bodily abuse—efficiently strengthen the sexual organs—control every muscle of your body—store up energy for feats of strength, also: Complete relaxation and contraction—Effective breathing—the best way to arouse your inactive nerves—creation of better blood circulation—easiest way to increase your chest circumference—the



ANTONE MATYSEK

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You send your money to me ONLY under an absolute guarantee that I can help YOU as explained in the coupon. Act NOW and you will always consider this the best two dollar investment of your life.

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Muscle Control Dept. 1501

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Detach and mail NOW while it is on your mind.
PROF. MATYSEK, Muscle Control Dept. 1501,
523 N. Charles Street, Baltimore, Md.

I want bulging muscles and yet I want them to have fine outlines. I desire to increase my strength, my internal activity, my energy, my manly powers. I want to be more than I am now and I want to achieve my "chief aim" in a short and efficient manner. For these reasons send me your wonderful Muscle Control Course, illustrated with 21 high grade pictures of yourself. If I am not completely satisfied, my money will be promptly refunded if course is returned within 48 hours.

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LETTERHEADS. Envelopes, 500 \$2.65. Samples free. Quality Printery, Marietta, Ohio.

BETTER printing for less money! Send for our large package of samples of hundreds of items every user of printing is interested in. These samples worth dollars will be sent for 10 cents to pay postage. Ernest Fantes Company, 525 South Dearborn Street, Chicago.

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125 Letterheads and 125 Envelopes, \$2.10 postpaid. Samples 5c. Wellman Printing, Huntington, West Virginia.

EMBOSSED Business, Personal Stationery. Samples, Stamp. Daniels P. Company, Pittston, Pennsylvania.

LETTERHEADS \$3.50 1000, envelopes, \$3.00 1000; Merrick Printing Service, 357 West 63rd Street, Chicago, Illinois.

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INVENTORS, send sketch or model of your inventions for opinion, concerning patentable nature and exact cost of applying for patent. Book "How to Obtain a Patent" sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandee & Chandee, 405 Seventh Street, N. W., Washington, D. C.

PATENT applications filed on partial payment plan. Trade-marks, Copyrights, etc. Milo B. Stevens & Co., 640 F St., Washington, D. C.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

PROTECT your rights. Write for "Record of Invention" which contains form to establish evidence of conception of your invention. Prompts personal service. Preliminary advice without charge. J. Beane Kelly, 612-P Columbian Building, Washington, D. C.

INVENTORS, before disclosing your idea to others write for our "Evidence of Disclosure" form. Send sketch or model of your invention for examination and advice. Ask for free book "How to Obtain a Patent." Avoid dangerous delays. Write to-day. Morton-Roberts & Co., 120 Mather Bldg., Washington, D. C.

PATENTS. My fees in installments. Advice book free. Frank Fuller, Washington, D. C.

PATENTS on easy payments. Particulars free. H. Kaye Martin, 17 Park Row, New York.

PATENTS. Prompt and efficient service personally rendered. Twenty years experience. Reasonable charges. Leech & Company, 307 National Savings and Trust Building, Washington, D. C.

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AGENTS AND SALESMEN WANTED

AGENTS make 500% profit handling Auto Monograms New Pictures, Window Letters, Transfer Flags, Novelty Signs, Catalog Free. Hinton Co., Dept. 125, Star City, Indiana.

MAN in each town to refinish chandeliers, brass beds, automobiles, by new method. \$10 daily without capital or experience. Write Gunmetal Company, Avenue "F," Decatur, Illinois.

MAKE \$314 Monthly selling patented vest-pocket windshield cleaner; Pads made this way; one rub keeps entire windshield clear 24 hours; chemical-deft; enameled mounting; guaranteed one year; sells \$1. Security Mfg. Co., Dept. 361, Toledo, Ohio.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Company, Dept. 467, Amsterdam, New York.

AGENTS make over 100% profit. Eradium (Luminous) Crucifix. Shines in the dark. Sells \$2.00. Costs 80c. Complete Line Luminous Articles: Crucifixes, Bulbs, Switch Plates, House Numbers, Match Boxes, Novelty Ornamental! Useful! Every home a prospect. The Pioneer Corporation, 1263 W. 63rd Street, Chicago.

SELL Ladies' Art Embroidery Needles. Retails \$1. Write for agency. Eugene Marquis, 5203 North Keystone, Indianapolis, Indiana.

OUR Patent Sanitary Hair Brush, Spray Bath Brushes, etc., easily sold to everybody. Complete line or side line samples returnable. Santax Co., 2350 Wabash Ave., Chicago.

SALESMEN wanted to sell Electric Cigar Lighters and Molotenes. Salary or Commission. You carry stock or we ship direct. Write for Special Offer. Drake Manufacturing Company, 220 Grand, Milwaukee, Wisconsin.

BIG Money and Fast Sales. Every owner buys Gold Initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Company, Dept. 47, East Orange, New Jersey.

PATENTS. Write for Free Illustrated Guide Book. Send sketch or model for free opinion of its patentable nature. Highest references. Prompt attention. Reasonable terms. Victor J. Evans & Co., 174 Ninth, Washington, D. C.

AGENTS: Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Staibrite Company, 1115 Second Avenue, New York.

SIGN Agents to represent us in your locality: unlimited field. Samples free. Interstate Sign Company, Dept. A, 2620 North Halsted Street, Chicago.

POLMET polishing cloth cleans all metals. Retails 25 cents. Sample free. F. C. Gale, 15 Edinboro Street, Boston.

AGENTS—Every automobile owner wants gold initials on doors of his car; transfer them without experience in 10 minutes; profit \$1.40 on \$1.50 job. Write for samples; agency. Transfer Monogram Co., Inc., Desk 8, 222 Market Street, Newark, New Jersey.

SALESmen—Earn \$3,000 to \$10,000 a year. City or traveling. Experience unnecessary. Quickly qualify through our amazing system. Free employment service to members. Send for salesmanship book, list of lines and full particulars. National Salesmen's Training Association, Dept. 126M, Chicago, Illinois.

AGENTS: Sell rich looking 36x68 imported rugs, \$1.00 each. Carter, Tenn., sold 115 in 4 days; profit, \$57. You can do same. Write for sample offer and selling plan; exclusive territory. Sample rug by parcel post prepaid \$1.39. E. Condon, Importer, 12 Pearl Street, Boston, Massachusetts.

KEROSENE Burners for Furnaces, Cook and Heating Stoves. Economy Mfg. Company, 518 West Monroe, Chicago.

AGENTS. \$60 to \$200 a week. Free samples. Gold Star Letters for Store and Office Windows. Anyone can do it. Big demand. Liberal offer to general agents. Metallic Letter Co., 431A N. Clark Street, Chicago.

AGENTS! Here's the Big Money Getter. You give Pair Dressmakers Shears FREE with each sale of "Winning 7" at \$1.50. Everybody buys. 100% profit. \$16-\$20 Daily Profit. Particulars Free. E. M. Davis, Dept. 51, Chicago.

NEW invention. Oil Gauge for Fords. Sells on sight. Big profits. Small investment. Exclusive territory. Unusual opportunity for agents and salesmen. Address Sales Mgr., 44 Sta. C, Omaha, Nebraska.

\$16 WORTH of finest toilet soaps, perfumes, toilet waters, splices, etc., absolutely free to agents on our refund plan. Lascassan Co., Dept. 615, St. Louis, Missouri.

EVERY man needs it. Every man you sell starts an endless chain of boosters. Send twelve cents for samples of new back collar button, retailing ten and twenty-five cents. Money back guarantee. Puritan Mfg. Co., 215 Produce Exchange Building, Toledo, Ohio.

SALESmen—Our Pocket Check Protector, sells on sight. Answers purpose \$25 machine. Lasts lifetime. Big commissions. Sample 50c. Roberts Mfg. Co., 102 Fulk Bldg., Little Rock, Arkansas.

SENSATIONAL—Opportunity. One sale a day means \$200 per month! Five sales, \$1,000 per month! Marvellous new adding machine. Retails \$15. Work equals \$350 machine. Adds, subtracts, multiplies, divides, automatically. Lightning speed. Errors impossible. Five-year guarantee. Used by U. S. Government and largest corporations. Tremendous demand everywhere. Amazing profits. Write quick for trial offer and protected territory. Calculator Corporation, Dept. O, Grand Rapids, Michigan.

LIVE salesmen for virgin territory to handle nationally advertised household necessity. Every home a prospect. Sells on sight. Fast turnover. Small capital required. Profits guaranteed. Write for details to-day. Knape & Vogt Co., Grand Rapids, Michigan.

AGENTS! Sell your own brand. Extracts will not freeze or bake out. Vanilla, gallon \$1.65, lemon \$3.50. Household Mfg. Co., 3853 Wentworth Avenue, Chicago, Illinois. B. 44.

EARN \$2.00 an hour in your spare time taking subscriptions for this magazine. Write to-day for the agency in your town. Popular Science Monthly, 225 West 39th Street, New York.

EASY, pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

AGENTS—Best seller: Jeep Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 500 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

AGENTS for to-day's best selling accessory. Nifty leaf spring oilers, oils your springs, stops squeaks and breaks; makes Fords ride easy. 100% profit. Sample Ford set of four for \$1.50 and agents' proposition. Springset Co., Schmid Bldg., St. Joseph, Missouri.

FOUND! The easiest article to sell. 200% profit. Write for particulars. Sample \$2.50. Premier Specialty Sales Co., 806 E. Grand Blvd., Detroit, Michigan.

BIG profits in fastest selling article available to agents to-day. Three-in-One-Holder is new invention necessary for Home, Workshop, Store, Garage and Office. Sells two for a quarter. Agents 75c per dozen. Money refunded if not satisfactory. Tremendous seller because of its many uses. Write for particulars: Ribbon Steel Products Corp., Room 909, 114 Liberty St., New York.

DO Lettering by Transfer Method. Big Money, Small Investment. Monogram Company, 16 Green Street, Newark, New Jersey.

MANUFACTURE These Goods Yourself—Small Investment Enormous Profits—Let Others Do the Selling for You. Noetheral Ice-Saving Cloths; Concentrated Summer Drinks; Amazon Rubber Repair; Cocoanut Creme Custard; Vans; Launderite Washing Compound; Ant Paper; Banker's Acid-Proof Ink (powdered); Ceile Skin Whitener and Many Other Hygiene Meritorious Specialties—all Uses from Miller's Guaranteed Reliable Manufacturer's Formulas and Commercial Information. Stamp brings fullest details and valuable information for Profitable Business. Miller, Chemist (old Reliable Established 1897), Tampa, Florida.

SELL necessities. Everybody needs and buys the "Business Guide." Bryant cleared \$900 in July. Send for sample. It's free. Nichols Company, Box 1B, Naperville, Illinois.

EXCLUSIVE representative for three fast-selling, repeating, typewriter specialties. Manufacturer, 404-E Sun Building, Detroit, Michigan.

WORLD'S fastest selling auto accessory! County distributors wanted; write to-day. G. L. W., Spring Oiler Co., San Diego, California.

SUNLIGHT for Fords. Bright light switch and dimmer fits on steering post. 100% profit for agents. Sells on sight. Price \$3.50. Sunlight Co., Box 394, Chicago.

LUMINOUS PAINT—Makes any article visible in the dark. Bottle, 5cc. Guaranteed. Sample, particulars for "Red" stamp. Illuminant Company, 54281P Rice Street, Chicago.

CHOCKFULL money making plans, formulas, ideas. Most useful magazine in America. Sample copy free. Everybody's Business Digest, Memphis, Tennessee.

FORDS run 34 miles per gallon on cheapest gasoline or half kerosene, using our 1921 carburetor. Increased power; styles for all motors; attach yourself. Money back guarantee; 30 days trial. Big profits to agents. Air Friction Carburetor Co., 1505 Madison Street, Dayton, Ohio.

56 Miles per gallon made with new patented gasoline Vaporizer. Write for particulars. Vaporizer Company, Pukwana, South Dakota.

\$15.00 DAILY selling the New Ambeord Unbreakable Combs; kind you can hit with a hammer; write for wholesale price. J. Bucknam, Box 2792, Boston, Massachusetts.

MAKE \$25 to \$50 week representing Clow's Famous Philadelphia Hosiery, direct from mill—for men, women, children. Every pair guaranteed. Prices that win. Free book "How to Start" tells the story. George Clow Company, Desk 24, Philadelphia, Pennsylvania.

AGENTS—Newest Invention "Inkspoon" makes every pen a fountain pen. Fast office seller; big profit. Demand increasing everywhere. Exclusive territory offered. Sample free. H. Maru & Company, Tribune Building, New York.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists' Accessories Company, Mansfield, Ohio.

WANTED: Agents to sell the greatest set of Nature Books ever published. Big Commission. Sells on sight. Inquire Desk 1786. Northwestern School of Taxidermy, Omaha, Nebraska.

RADIOBRITE (Luminous) Signs, Furnished Rooms, Boarding, shine in the dark. Big profit. Sample 75c stamp brings particulars. W. H. Drake Company, Dept. 7, 443 West 15th, New York.

AGENTS and portrait men. Crew Managers. We give you more for your money. Better and quicker service. Lowest prices on frames and glass. Rejects credited. Catalog free. The Pioneer Corporation, 1263A West 63rd Street, Chicago.

DISTRICT Managers wanted for tremendously successful new office specialty. Two minute demonstration means sale. Wonderful repeater. Gold mine for you. Perfection Mfg., 123 So. Fourth, Philadelphia, Pennsylvania.

AGENTS—Our Marvel Can Opener opens a can in two seconds. Sells on sight—big profits—samples free to workers. Staples Mfg. Co., Mt. Vernon, Indiana.

AGENTS WANTED—to sell Stephens Vacu-Grip Inner Tires. Best agency proposition ever offered. Inner Tire sells itself where shown. Made like a tire and vacu-grips on its soft, red rubber tread prevents its slipping after casings is inflated. Users say its vacu-tread actually makes outer casings more resilient. Our sample Inner-Tire is 30x3½ and costs you only \$2.50. You retail it at \$5.00 and make one hundred per cent. You order your tires direct from us. There's easy money in selling Vacu-Grip Inner Tires to your friends and acquaintances. Order sample tire to-day. Use money order or draft. We will send you 30x3½ sample and prices on other sizes. Address A. J. Stephens Rubber Company, Dept. A-3, Kansas City, Missouri.

"WEAR-EM-LOOSE"—Be comfortable! "Outosite" aluminum side suspenders unify shirt and trousers; agents' sample 50c; Woods, 503A North Seventh, St. Louis, Missouri.

BEGINNERS' complete mail order system. PS., Box 1005, Atlantic City, New Jersey.

SELF-THREADING needles. Every housewife buys \$15 daily. Sample free. Maher Co., Dover, New Jersey.

MAKE \$25 daily selling guaranteed article needed by every auto owner. Simple demonstration makes sale. Each sale \$2.50 profit. Ten sales a day easy. \$3 starts you. Get details quick. Auburn Handle Co., Auburn, Indiana.

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MEN and Women, sell our Self Hair Cutter and be successful. Our agents doing wonderful. Sample, \$1.00. Particulars on request. Sanitary Mfg. Supply, Akron, Ohio.

NEW Selling Plan. Men wanted to supply consumer demand for our Sugar, Flour, Canned Goods, Dried Fruits, Coffee and other staple Groceries and Paints, Roofing, Aluminumware and Automobile Oils. Entirely new plan. Not one penny of investment in samples or goods required. No experience necessary. Our men are making big profits and have a permanent repeat order business. Address Hitchcock-Hill Co., Dept. 220, Chicago, Illinois. Reference any Bank or Express Co.

AGENTS—Something new. Write quick for particulars. F. O. Spaulding, Fairfield, Maine.

"THE SCHEMER," Alliance, Ohio, prints big profit-producing schemes; one subscriber making \$25,000 from three schemes; another \$10,000 from one. Make thousands yourself. Year, \$1.00; three months, 25c.

GALLAHER made \$336.00 one week selling guaranteed Collection Systems used by all business men. Sayers Mfg., 2831, Sheffield, Chicago.

350% Profit selling Klean-rite Magic Clothes Washing Wonder. Sells 25c. Profit 19c. Sample free. Bestevers Products Company, 1941-T9 Irving Park, Chicago.

STOP here: make \$30 next Saturday. Agents—Salesmen—District Managers—brand new invention—selling like wildfire. Sell Speederators for Fords. Makes any Ford run like a Packard. Stops stalling and bucking. Put on quick—no tools nor holes to bore. Instant satisfaction. Listen: make money quick—\$75 to \$150 week easy. Helton, Utah, makes \$300 every week. McAllister, Ill., made \$12 first afternoon. Dane, W. Va., \$55 week spare time only. Hurry, write quick for details and exclusive territory. Address Perrin Company, 1102 Hayward Bldg., Detroit, Michigan.

AGENTS—If you want fast selling profitable articles for auto-owners, garages, etc., write for full particulars. Ry-Hy Mfg. Company, Stamford, Connecticut.

AUTO Owner Tire Agent wanted each locality to use and take orders for hand-made Mellinger extra ply and cord tires; guaranteed by bond for 8,000 and 10,000 miles (no seconds); shipped prepaid or approval; get your tires free; no capital or experience required; make \$100 to \$300 weekly. Write for wholesale prices and sample sections, Mellinger Tire Co., 929-R Oak, Kansas City, Missouri.

SELL most wonderful musical instruments anybody can play without learning. Make \$100.00 weekly easy. Write for free sample offer. Oriol Co., 15 Park Row, New York.

SALESMANAGERS High-Grade Proposition. "Tempt" the Wonderful New Clothes Washing Machine sells \$5. Salesmen's sample \$2. 150% profit. Particulars free. Wakeley Mfg. Co., Waterbury, Connecticut.

ASTONISHING invention—for automobiles, absolutely prevents accidents; costs agent \$2.50 postpaid; retails \$7; sell selling sales plan. Carl Brown, Mgr., Dept. 14, Columbus, Ohio.

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MEN and WOMEN—Become independent—own your business, experience unnecessary selling our \$6,000 Accidental Death, \$30.00 Accident, \$25.00 Sick Weekly Benefits, \$10.50 yearly, half amounts \$5.50. Guaranteed steady income from renewals. \$250.00 deposited insurance Department. Registration Dept. S, Newark, New Jersey.

BE successful—Easy sales—Big money. Only \$1.00, Double Edge Razor, Standard Safety Razor Corporation, Pittsburgh, Pennsylvania.

AGENTS wanted everywhere to sell absolutely essential article. Castor Oil Stick Belt Dressing. Used in all manufacturing plants, mills, machine shops, factories, etc. Sample free. Neatsfoot Oil Products Co., Long Island City, New York.

SELL Perfume Blocks. One 50c Block perfumes an entire room for two months. Used in trunks, clothes closets, sick rooms, theaters, enclosed automobiles, etc. 100% profit. International Chemical Company, Box 174D, Cleveland, Ohio.

SEND for free sample Fretnot Washday Wonder. Be convinced you can do a whirwind business. Constant repeater with large profits. You take no chance. We positively guarantee sale. F. S. Motter & Sons, 20 E. Jackson Boulevard, Chicago.

HELP WANTED

OUR genuine gold window sign letters are an excellent money-making proposition for handy men. Slann Sign System, 7505 St. Antoine, Detroit, Michigan.

MEN—Age 17 to 45. Experience unnecessary. Travel, make secret investigations, reports. Salaries, expense. American Foreign Detective Agency, 321, St. Louis.

SILVERING mirrors, French plate taught. Easy to learn, immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Missouri.

MEN wanted for Detective Work. Experience unnecessary. Write J. Gandy, Former Government Detective 115, St. Louis.

WRITE Photoplays: \$50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

\$135 MONTH Commerce. Railway Mail Clerks. Hundreds needed. List positions free. Write immediately. Franklin Institute, Dept. N 42, Rochester, New York.

BIG MONEY Made Silvering Mirrors, metal plating, refinishing. Outfits furnished. F. Decis Laboratories, 286 Fifth Avenue, New York.

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Particulars free. Write American Detective System, 1968 Broadway, New York.

SPLENDID clerical work opportunity. Spare or whole time. No canvassing, good money. Chautauqua Business Builders, Jamestown, New York.

GOVERNMENT Clerks needed badly (men-women). \$1600-\$2300. Permanent. Few to travel. Write Mr. Orament, Former Government Examiner, 195 St. Louis, Missouri.

GOOD money easily earned at home, spare time silvering mirrors; no capital; free instructive book tells how. Paterson Company, Brooksville, Kentucky.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

FOREIGN trade is the subject of great importance before Congress, our financiers and manufacturers. Our foreign business will require thousands of trained men and women. Properly trained students will have a splendid future. Write for our prospectus showing the only practical course offered. Foreign Trade Institute of Seattle, 706-A Arctic Building, Seattle.

BE a Railway Traffic Inspector! \$110 to \$250 monthly, expenses paid, after 3 months' spare-time study. Splendid opportunities. Position guaranteed or money refunded. Write for Free Booklet CM-13. Standard Business Training Institute, Buffalo, New York.

BE a Mirror Expert, \$3-\$10 a day; spare time at home first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. F. Derr, Pres., 579 Decatur Street, Brooklyn, New York.

BUSINESS OPPORTUNITIES

SUBSTANTIAL manufacturing corporation wants capable men to establish branch and manage salesmen. \$300 to \$2000 necessary. Will allow expenses to Baltimore as explained. Address Mr. Clemmer, 603 N. Eutaw Street, Baltimore, Maryland.

PATENTS Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Building, New York.

EXPERT Chemist will furnish Formula and Trade Secrets in all lines. Lists free. W. L. Cummings, Ph. D., Gordon Avenue, Syracuse, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

DOLLARS Yearly in your backyard. No mushroom dope. Particulars free. Metz, 252 West 41st, New York.

USED correspondence courses sold, rented and exchanged. List free. (Courses bought.) Lee Mountain, Plagah, Alabama.

I MADE \$25,000 with small Mail Order Business. Sample article 25c. Free booklet. Stamp. Alps Scott, Cohoes, New York.

ENTER a new business. Earn \$3,000 to \$6,000 yearly in professional fees making and fitting a foot specialty; openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy, job hunting, soliciting or agency. Address Stephenson Laboratory, 15 Back Bay, Boston, Massachusetts.

WE start you in business, furnishing everything. Men and women, \$30.00 to \$100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime. Booklet free. H. Ragsdale Company, East Orange, New Jersey.

MANUFACTURING Co-operation: A large, modern Middle Western Manufacturing Institution will consider proposals from inventors and small manufacturers for the purpose of buying outright or manufacturing on royalty. Prefer light brass products, but will consider any high grade proposition. Write at once Box 338, Kokomo, Indiana.

200% Profit Manufacturing Big Seller—New Field—\$31.50 Buys Complete Equipment. Box 121-A, Akron, Ohio.

SMALL Mail Order and manufacturing business for sale. Can operate from home. Make toys, sell novelties, etc., by mail. Dies, books and little stock \$150. Splendid future. T. Catino, 1001 North Central Park Avenue, Chicago.

HONEST, Maine people, seeking profitable home work. What can you offer? H. N. Jenkins, Limestone, Maine.

"**FIVE** Hundred Opportunities for Profit and Distinction" by Henry Woodhouse, may lead you to success. It also tells of Inventions, Discoveries and Activities That Created Billion Dollar Industries and defines Billion Dollar Industries To Be. Mr. Woodhouse unaided achieved financial independence, international prominence and distinction before thirty-five. Send \$2.00 for a copy. The Scientific Library, No. 299 Madison Avenue, New York. (Established 1914).

WE teach you all there is to know about candy making in our Correspondence Course. \$50.00 to \$100.00 a week can be made at home with a very small investment. The Candy College, Flatbush & Church Avenues, Brooklyn, New York.

YOU can have a business of your own for \$100.00 or \$200.00 in your spare time. The Business Encyclopedia tells how. Write for particulars Henry Nelson, 1241 Madison Street, Eau Claire, Wisconsin.

PATENTS—Book free. Send sketch for free Opinion of patentable nature. Talbert & Talbert, 437 Talbert Bldg., Washington, D. C.

I MADE \$30 a week home. French breadmaking. 15 years' experience; free booklet tells. Ashbrook, E. 67, Marengo, Ohio.

START in a permanent business of your own selling guaranteed Hosiery and Underwear direct from mills. No capital or experience needed; many representatives make \$1,000 to \$5,000 per year. Become our district manager; get others working for you. Write for details to Malloch Knitting Mills, 119 Ottawa Street, Grand Rapids, Michigan.

STAMPS AND COINS

51 different stamps, also packet 5 unused, China ship set, 2 scarce animal stamps, large \$1.00 U. S. revenue, perforation gauge, millimeter scale, ruler and price lists. All for 9c. We Buy Stamps. Fennell Stamp Co., Dept. C, Fullerton Bldg., St. Louis, Missouri.

CALIFORNIA gold, quarter size, 27c; 5½ size, 53c. White cent and catalogue, 10c. Norman Shultz, Box 146, Colorado Springs, Colorado.

1000 different stamps. \$3.00: 500, \$1.25; 200, 25c; 100 12c. Approvals. Michaels, 5602 Prairie, Chicago.

CALIFORNIA Gold, quarter size and German 5pf 30c. Villa coin and catalog 10c. Homer Shultz, Union Star, Missouri.

158 Genuine Foreign Stamps—Mexico War Issues Venezuela, Salvador and India Service, Guatemala, China, etc., only 10c. Finest Approval Sheets 50¢ to 60¢. Agents wanted. Big 72-p. Lists Free. We buy stamps. Established 25 years. Hussman Stamp Company, Dept. 55, St. Louis, Missouri.

STAMPS, 20 unused. All Different, 3 cents. Mention paper. Quaker Stamp Co., Toledo, Ohio.

STAMPS—50 varieties, Africa, Brazil, Peru, Cuba, Mexico, etc., and Album 10c. 50 different U. S. 25c, 500 hinges, 10c, 1,000 mixed, 40c. List free. I buy Stamps. C. Stegman, 5949 Cote Brilliante, St. Louis, Missouri.

AUSTRIA, 1916. Sixteen beautiful varieties, used, catalogue, \$5.00; seldom offered, only \$1.15. John Fox, 3142 Dale, San Diego, California.

FRENCH Colonials, 25 different, only 10c. Nickles, 122 Florida Avenue, Washington, D. C.

55 ALL DIFFERENT stamps, including China, Japan, French Colonies, etc., given to applicants for our high grade approval selections. Send references and 2c stamp to the Edgewood Stamp Company, Dept. M., Milford, Connecticut.

OLD coins, large Spring selling catalogue of coins for sale, free. Catalogue quoting prices paid for coins, ten cents. William Heisslein, 101A Tremont Street, Boston, Massachusetts.

17 VARIETIES Bulgaria stamps. 20 cents. List of 7,000 low-priced stamps free. Chambers Stamp Company, 111C Nassau Street, New York City.

PACKET free. Write for approvals. Essex Stamp Company, Hebron, Maine.

30 Different Sweden, 15c. Browne Stamp, 111 Willow, Wollaston, Massachusetts.

222 Different Stamps 25c. C. Reitter, Box 1054, Detroit Michigan.

FREE. Ten animal stamps to approval applicants. Emery, 367 Oakwood Avenue, Toronto, Canada.

FRENCH Colonies free. Beautiful set, pictures, wild native chief, animals, 2c postage. Empire Stamp Company, Toronto, Canada.

50 Different Stamps, best packet we ever offered: Austria, Estonia, Germany, Hungary, Liechtenstein, Serbia, Turkey. All for 10c. Catalog value over \$1.50 sent to applicants for approvals only. Lakewood Stamp Company, Dept. O, Lakewood, Ohio.

TURKEY, 54 Varieties \$1.00. Mouhib, 608 West 135th Street, New York.

5 Varieties Cuba free with order for 100 war stamps for 16c. Gast, 588 Jackson, Milwaukee, Wisconsin.

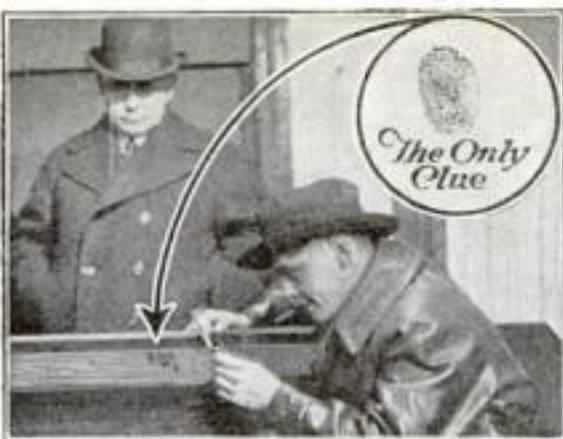
BOOKS

WIRING is made easy for anyone with an elementary knowledge of electricity by the use of Senstock's Electricians' Wiring Manual. Just follow the simple instructions in this manual and Do Your Own Wiring. The book is written in plain English within the grasp of any one. You need not worry about your wiring passing inspection if you have this manual. Pocket size, flexible binding. Price, postpaid, \$2.50. Popular Science Monthly, 225 West 39th Street, New York.

DO you have the 110-volt alternating current in your home? Would you like to know something about the most common form of electricity in commercial use? Then get a copy of Adams' "Experiments with 110-Volt Alternating Current." You will be amazed when you learn how many interesting experiments can be performed with home-made apparatus and how in a short time you can become thoroughly familiar with the 110-volt alternating current. 135 illustrations showing exactly how to make the apparatus and perform the experiments. Price, postpaid, \$1.75. Popular Science Monthly, 225 West 39th Street, New York.

20th Century Book of Recipes, Formulas and Processes. 10,000 trade secrets, practical recipes, chemical processes and scientific formulas. How to make thousands of things for the home, factory and workshop. It is a great money-maker and tells how to make such things as Antiseptics, Waterproofing, Lubricants, Rust Preventatives, Dyes, Filters, Cleaning Preparations, Enameling, Beverages, Inks, Adhesives, Polishes, Disinfectants, Flavorings, Cosmetics, Ceramics, etc., etc.; how to make paper; to color flowers artificially; to estimate weight of ice by measurement; to make materials fireproof; to work with metals—aluminum, brass, etc.; to make anything and everything from A to Z. Price, postpaid, \$4.00. Popular Science Monthly, 225 West 39th Street, New York.

THE Real Estate Educator—A Book for hust



\$500 REWARD for TWO HOURS WORK

In answer to a request from the Chief of Police, Warren Biglow, the Finger Print Expert, arrived at the scene of the daring robbery of the O— Company offices. \$6500.00 in currency was gone. Not a single clue had been found.

Almost immediately Biglow turned his attention to a table which had been tipped up. The glossy mahogany showed an excellent set of finger prints. *The thief might just as well have left his calling card.*

To make a long story short, his prints were photographed, and matched with those of "Big Joe" Moran, a safe blower. Moran was caught and convicted on Biglow's finger print proof. The money was recovered and a \$500.00 reward given to Biglow, in addition to his fees—as pay for his two hours' work.

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Popular Science Monthly

September, 1921; Vol. 99, No. 3
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Weighing Ghosts and Photographing Phantoms

How three European scientists brought
the "spirit world" into the laboratory

If This Is Not Fraud, What Is It?

YOU don't believe in spirits—nor in supernatural events. Then just how do you explain the weird happenings described in these pages? A few bold men, themselves scientists of distinction, have lately been conducting psychic experiments during which certain mediums appeared to exude a strange

substance from their bodies. The experimenters assure us that they have exercised the most rigorous scientific control over the medium.

This brief account of their work gives you a glimpse of the very latest experiments in an always fascinating field of research.

AFTER twenty years of investigation, several eminent scientists of England, France, and Germany claim to have made definite discoveries concerning the "spirit forces" of the séance chamber.

By the use of the camera, of weights and scales, and of electrical apparatus, these investigators have tried to prove the existence of an unknown but material substance which the séance medium puts forth from her body and with which she lifts tables or "materializes" human faces that may certainly be likened to the "ghosts" of superstition.

Many Mediums Are Hysterics

The Popular Science Monthly holds no brief for spiritualism; but it does believe that it is the business of science to investigate and not to condemn before an investigation. Some of the mediums, like the famous Eusapia Palladino, proved to be frauds; but even Eusapia's performances were not always to be explained on the ground that she was an habitual cheat. The truth is that most mediums are hysterics. In the trance state they lose their normal personalities. Normally a medi-



An enlarged flashlight photograph of "Eva C.," showing the lacelike substance exuded from her mouth

um may be a model of propriety and honesty; in a trance she may be a liar and a fraud.

It matters not so much whether the medium cheats as whether the investigator is deceived. It is the function of science to study these trance states, to interpret the phenomena of hysteria and to tell us why the normal woman ceases to be herself in a trance. All this is straightforward psychological investigation. Control of the most rigorous kind must be exercised.

Strict scientific control seems to have been maintained in astonishing investigations made in Europe by the late Dr. W. J. Crawford of Belfast, Ireland, and by Dr. A. von Schrenck-Notzing of Munich, and by Dr. G. Geley of Paris. A committee of the British Society for Psychical Research has checked up the records in some of their cases and has endorsed the results.

What Is This "Plasma"?

In the experiments of von Schrenck-Notzing, Geley, and Crawford there seems to be evidence that some material substance, called "plasma," something that is highly sensitive to light,



"Plasma" exuding through the fingers of "Eva C.," one of Dr. Geley's experiments. "Plasma" is described as something that is highly sensitive to light, but that can be photographed and felt: it can assume the shape of a hand, a face, or a whole figure



The head of a woman completely materialized by "Eva C." in one of Dr. Geley's experiments. Although here shown of miniature dimensions, Dr. Geley at the same séance saw the head of normal size, but missed his opportunity of photographing it

but that can be photographed and felt, although it is normally invisible, something that can assume the shape of a hand or a face or even a whole figure, something that can move an object, is thrust from the body of the medium.

Dr. Crawford, who was an engineer, tested the plasma mechanically. He even weighed it. Dr. von Schrenck-Notzing has photographed it. Although ordinarily invisible, he also succeeded in collecting samples of it, which he studied microscopically, and which he found to be curiously like human skin in cellular structure. Both Dr. von Schrenck-Notzing and Dr. Crawford agreed that as it issued from the body they felt "a kind of breeze caused by material particles of a cold, disagreeable, sporelike matter."

The Plasma's Course Is Traced

Dr. Crawford, in his book, "The Psychic Structures at the Goligher Circle," said that when the plasma was taken out and he put his hand on the lower part of Miss Goligher's back "the flesh seemed to become soft and cave in, . . . filling out again as the psychic stuff apparently returned to her." He put dye-stuffs within the medium's stockings and underclothing, and thus he was able to map out the paths taken by the plasma in issuing from and returning into the body. It is not a dead substance, but alive. In the case of "Eva C." it is described as crawling about the body.

In all of these experiments the medium was carefully searched before and after each experiment. Eva C. was even given an emetic in order to preclude the possibility of her swallow-

ing something that she afterward ejected from herself. Miss Goligher would cause a table to levitate by means of the plasma, although she was not near it and although it was much too heavy for her to move vertically.

Impressions made by the plasma on clay always showed marks of the stocking fabric. The skeptic will at once argue that Miss Goligher must have released her controlled feet and impressed them in the clay. But Dr. Crawford states that the stocking marks were really impressions made on the plasma as it passed through the fabric, and different from any marks that an actual stocking could make. One of "Eva C.'s" plasma faces revealed the letters *miro*. The skeptics charged that it was an illustration from the Paris paper *Le Miroir* which she had swallowed and regurgitated, but the experimenter retorts that the picture could not have been a regurgitated piece of paper, for it was not like that produced by the process blocks of an illustration.

One of von Schrenck-Notzing's most interesting mediums was a Polish girl, Stanislawa Tomoczyk, who was once arrested by mistake, and who after a ten days' incarceration was so nervously shocked that she developed hysteria. When the prison doctor was writing out a prescription for her the inkstand started to move about, and raps could be heard. She developed multiple personalities. She would be (1) her normal self, (2) Stanislawa or "Stasia," a child ten years of age in the trance state, and (3) the double of

little Stasia. Von Schrenck-Notzing had to adapt himself tactfully to the playful whimsies of her childlike second personality in order to get results. He would joke with her to keep her in good spirits, or casually suggest a game, played by attempting to move small objects on a table without touching them. Stanislawa would then sit down at the table, and presently the phenomena would occur.

How Was the Box Lifted?

Keeping her hands about six inches apart, her fingers extended and her wrist on the table, she would wait for a prickling sensation to occur as a fore-runner of the plasma emanation. Von Schrenck-Notzing would place a small empty aluminum box with



Stanislawa Tomoczyk lifts a celluloid ball, without touching it, by means of an invisible thread which extends between her fingers and which, according to von Schrenck-Notzing, is an excrescence of her body

rounded corners in front of her. She would make a few passes over the box with hands parallel and three quarters of an inch apart, but without touching the box. Thus, she explained, she established a connection. Her fingers still kept three quarters of an inch from the box and moved to and fro parallel with the surface of the table. The box suddenly turned up with its left side pointing in and its right side out. The box then tried to rise on one of its narrow sides, and fell back.

The skeptic will say that some invisible thread or hair, held between the hands, moved the box. There is a thread—but a thread of plasma spun by the medium's own hands. Von Schrenck-Notzing lifted the arms and spread them apart more than a yard. An ordinary thread would have broken. Then he restored the hands and wrists on the table in their former position. Experiment after experiment was then made. A celluloid ball two inches in diameter was rolled away from the medium as by some invisible thread connecting the hands. A hand-bell was shaken, although the fingers of Stanislawa were two inches from it. A teaspoon in a tumbler was rattled about so that it struck the glass. Eventually the tumbler itself was upset.

Von Schrenck-Notzing has studied the threadlike plasma that connected this medium's hands. It was not equally visible from all sides. It could



Here Stanislawa Tomoczyk is lifting a filled test-tube without touching it with her fingers. This is a hitherto unpublished photograph by the late Professor Ochorowicz

not be seen against the light, but obliquely. A thorough search revealed no hair or thread on Stanislawa's hands. And yet all the phenomena was produced by some threadlike connection between the medium's fingers.

Before von Schrenck-Notzing became interested in the girl she had been experimented with by the late Professor Ochorowicz of Warsaw. The professor would place one of his hands on the table and ask

Stanislawa to make her passes. He had a sensation of cold, and he seemed to feel a very fine thread gliding over his skin. The farther the medium's hands, the finer the thread seemed to be. The sensation of a gliding thread disappeared entirely at a distance of about eight inches.

Von Schrenck-Notzing has studied these threads with the aid of stereoscopic photography. That they are not the ordinary threads used for fraudulent purposes his microscopic examination seemed to prove. The structure was not comparable with that of any known textile thread. He noted two relatively pasty lines with indistinct and irregular edges that disappeared and reappeared at intervals. In a weighing experiment in which balanced pans were used, von Schrenck-Notzing noticed two emanations acting in opposite directions. While the thread-like extension of the middle finger lifted the left pan, the plasma from the right hand tried to press down the right pan.

Here we have mediums who do not know one another, yet exhibit the same phenomena. From all of them some substance, which weighs many pounds, emanates. The phenomena are observed in different places by different experimenters, who assure us that they have taken every precaution to exclude possibility of fraud. These experiments need corroboration and interpretation.

London's X-Ray Ambulance



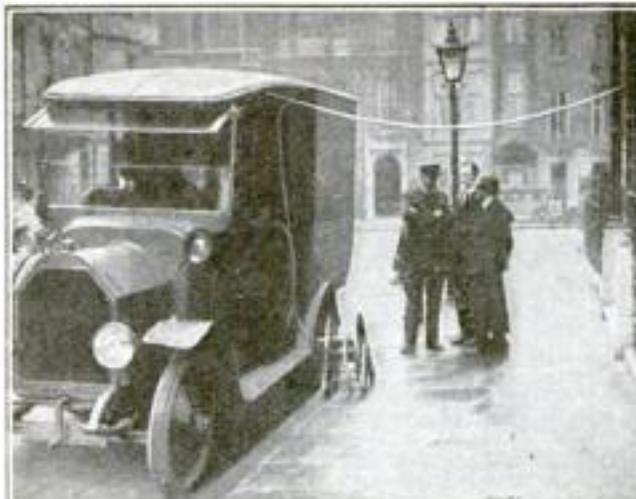
All ready to snap the photograph—and to develop it in the ambulance afterward

TAKING an X-ray picture is a complicated procedure. It has frequently happened that persons too ill to be moved to a hospital have been deprived of X-ray benefit simply because it and the bulky mechanism that projects and accompanies it could not be brought to them.

This difficulty has been remedied by the invention of a mobile X-ray apparatus. It consists of a portable

equipment for taking the photographs operated by current supplied through a cable from a motor-van in which the mechanism is carried.

The first mobile X-ray unit has been placed in operation by the British Red Cross in London. Attendants carry the apparatus to the patient's room, connect it with the ambulance by a cable, take the photographs, and develop them in the ambulance afterward.



The X-ray ambulance outside a patient's door supplying the needed power by cable

Blue Eyes Are Really without Color

SCIENCE declares that if your eyes are blue they are really colorless. There is no blue pigment in blue eyes. In an address delivered before the American Chemical Society, Professor W. B. Bancroft stated that their color is due to the scattering of light by a turbid medium, and eyes are blue from the same cause that gives the sky, or skimmed milk, or cigarette smoke, its apparent color.

Dark-eyed people have varying amounts of a yellowish-brown pigment in the front of the iris. When the yellow layer is very thin, the blue shows through and the eyes appear green. Thicker pigmentation produces the hazel, brown, or black eye.

In many cases the pigment does not develop before birth and consequently most babies' eyes are blue for the first few months.

Crows, hawks, and some owls also start life with blue eyes.

There is a popular belief that blue-eyed men are the best rifle shots, but this is a mistake, as army records will show.

The Huge "Guardian Angel" Parachute Designed to Save a Cabinful of Passengers

As important to passenger-planes as the life-raft to the liner

By Major T. Orde Lees,
A.C.F., O.B.E.

STATISTICS issued by the British Air Ministry regarding commercial flying in England since the Armistice show that in the last two years aircraft carried 106,712 passengers over a million and a half miles in sixty-two thousand flights. There were only forty-eight accidents, and of those twenty resulted in no injury to the personnel. In the other twenty-eight crashes eleven passengers were killed and seventeen injured.

The history of commercial flying in America is almost equally encouraging: 225,000 passengers were carried for a total of six million miles with only eighty-eight accidents.

Nevertheless, in the face of all statistics, the truth remains that flying is dangerous. The crash of the Eagle ambulance plane at Indian Head, Maryland, with a loss of seven lives, awakened the public to the dangers of airplane travel, and discouraged many would-be fliers.

It is not my purpose to alarm the man who thinks of flying from New York to Chicago, but simply to make the point that no one may fly year in and year out without courting death, unless he has the aerial equivalent of the marine life-preserved, which is a correctly designed parachute.

Only the Parachute Is Dependable

Now the problem of providing adequate parachutes for airplanes is not so easily solved as may appear at first blush to one who has never traveled by air. The ordinary balloon parachute is of little use on an airplane. The balloon moves along slowly, blown by the wind; it may be all but stationary. It is no difficult matter to step off. On the other hand, an airplane moves along at express-train speed. Indeed, it may be traveling at the rate of one hundred and twenty or one hundred and fifty miles an hour, particularly in one of those swift, sickening drops that follow when a gasoline-tank catches fire and wings crumple in flames. When the balloonist drops with his parachute, he is free

from the basket in an instant; but the man who attempts to leap from an airplane with a balloon parachute may court death. When he jumps overboard he has all the motion of the machine; he may be swept back, with the result that his parachute may foul the rear stabilizing surfaces. It is be-

This parachute must be of enormous dimensions. At the critical moment the pilot pulls a lever. The next instant the huge parachute jerks away the entire cabin with its precious human freight.

The great parachute itself is folded into a small compartment in the rear of the cabin and above it. It is apparent that the cabin must slip away easily from the machine. Hence it is drawn over rearwardly inclined ramps or rails; in some cases it may be rocked off on its rear upper end.

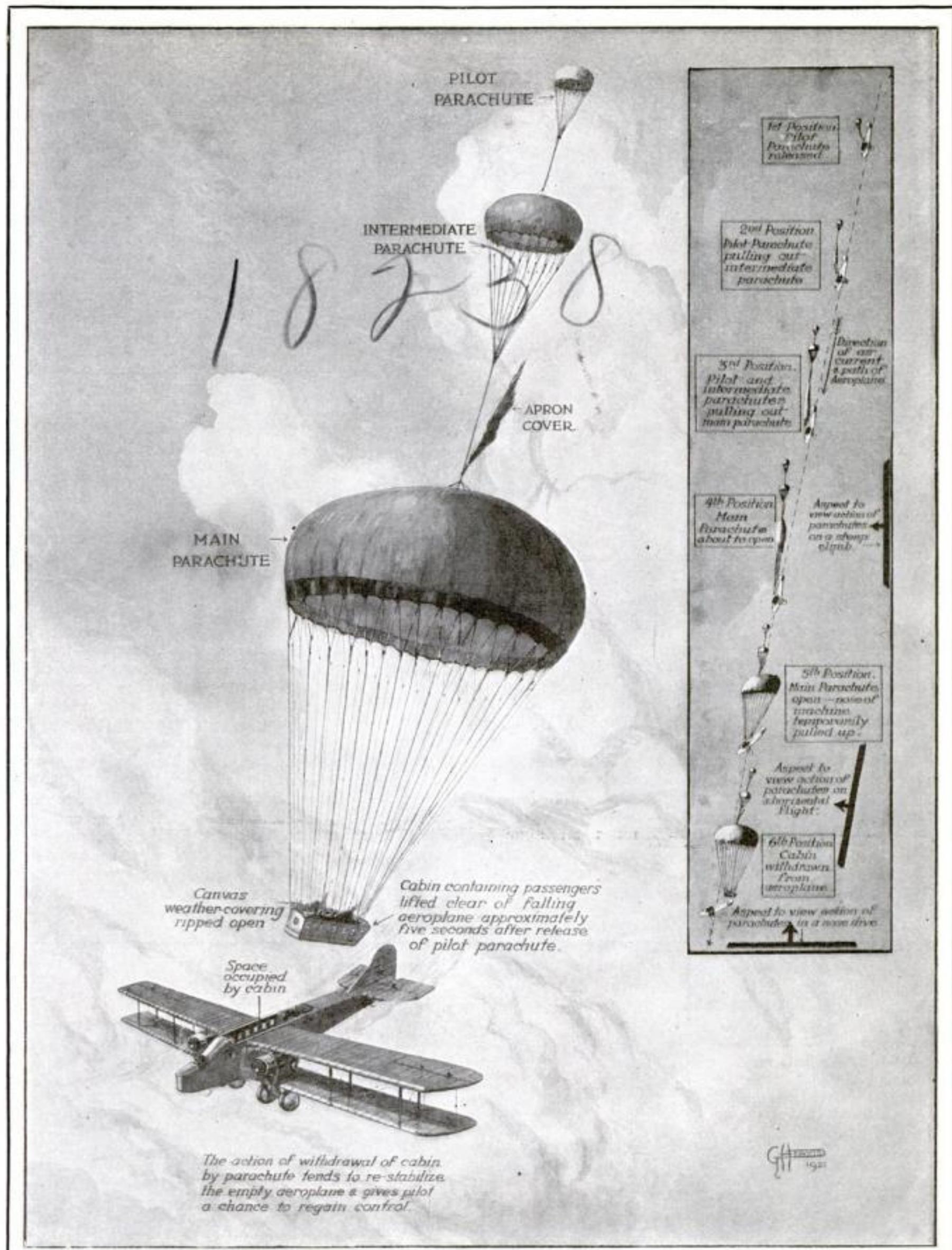
It would be difficult to release the cabin by means of the large parachute alone. Hence, Mr. Calthrop depends on small auxiliary parachutes. First, a small pilot parachute opens. This extracts an intermediate parachute. The intermediate parachute in turn pulls out the great *Guardian Angel*.

There is nothing new in this use of auxiliary parachutes. The principle had been successfully applied over and over again.

Experiments Must Continue

If inclined ramps are employed, the parachute is not likely to foul the stabilizing surfaces at the rear. The cabin simply runs up the ramp, and the parachute pulls it away while the machine moves on. It will cost many thousands of dollars to devise a giant parachute that will perform the function of an aerial life-raft. But the experiments out of which the parachute will evolve must be carried on. The best informed experts believe in the scheme, just as they believe that aerial life-saving appliances must be standardized, and that laws must be enacted to compel the owners of passenger aircraft to install them.

A great aerial disaster may do the development of commercial aeronautics incalculable harm. It is wise to carry out the researches suggested by Mr. Calthrop and to perfect a practical cabin parachute, which will reduce the ever-present peril to those who travel in passenger-planes.



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Drawing by G. H. Davis

How the Cabin Parachute Would Act in a Nose Dive

If the pilot loses control of the plane or meets other air disaster, he has only to pull a lever, which releases the pilot parachute. This will insure the opening of the intermediate and the main parachutes, and the cabin containing the passengers is pulled clear of the falling airplane in a backward direction and floats slowly to the earth.

There is practically no possibility that the parachute will fail to open, and by having the device under the control of the pilot, danger of panic is avoided, and the airplane is provided with a means of escape comparable to the life-boats at sea. This cabin-parachute is being developed by E. L. Calthrop.

Cable Loops Make Anti-Telescoping Cars

Steel noose will snare the invader and confine damage to the vestibule

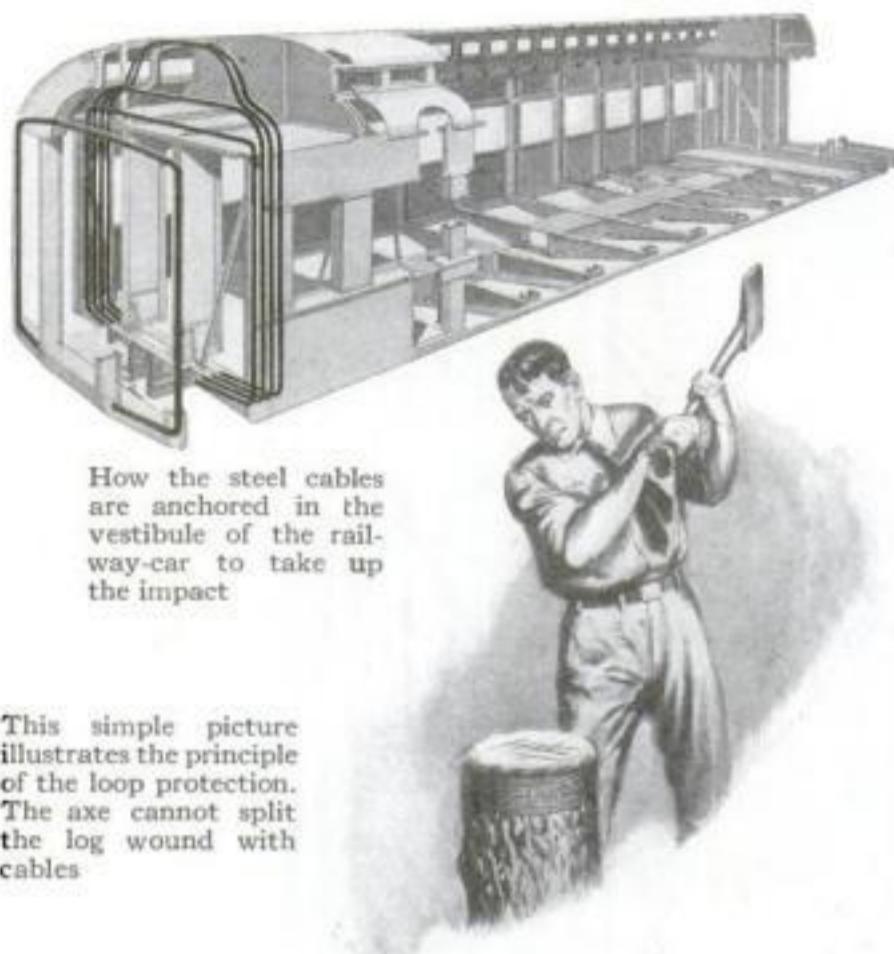
THE damage and loss of life in railroad wrecks are not confined to the car actually struck. Several cars in each train will be telescoped. No scene is more horrible than that of one passenger-car mounting the platform of another ahead and plowing through, sweeping and crushing. Steel crumples and tears like paper; wood disintegrates in a shower of splinters.

If the damage done to a coach could be confined to the vestibule, a serious collision might occur without loss of life, since the ends of a car might be badly crushed without danger to the passengers in the center of the coach.

The invention pictured in the illustration accomplishes this by building steel cables into the vestibule of each car, which snare and hold the oncoming engine or car, and prevent "telescoping."

The principle is simple. Imagine a log of wood with its ends tightly wound with a strong steel cable. It would be impossible to split this log unless a force great enough to part the cable was applied.

When steel railroad-cars are telescoped, they split in two parts, the ramming car acting as a wedge. Why not place a noose at the end of each car and prevent this telescoping?



How the steel cables are anchored in the vestibule of the railway-car to take up the impact

This simple picture illustrates the principle of the loop protection. The axe cannot split the log wound with cables

That is just what has been done. Five heavy steel cables are looped around the ends of cars and when the ramming car noses into these, their grip tightens over its end.

The cables are anchored so that they cannot be loosened by the impact of collision.

A passenger-train traveling sixty miles an hour represents a great amount of energy. When a rapidly moving body strikes a stationary object, this energy must be dissipated instantly. In the case of

the new cable-protected cars, the impact of the moving train will force the other train into motion. The force of the moving train is simply diverted from the work of destruction to producing motion.

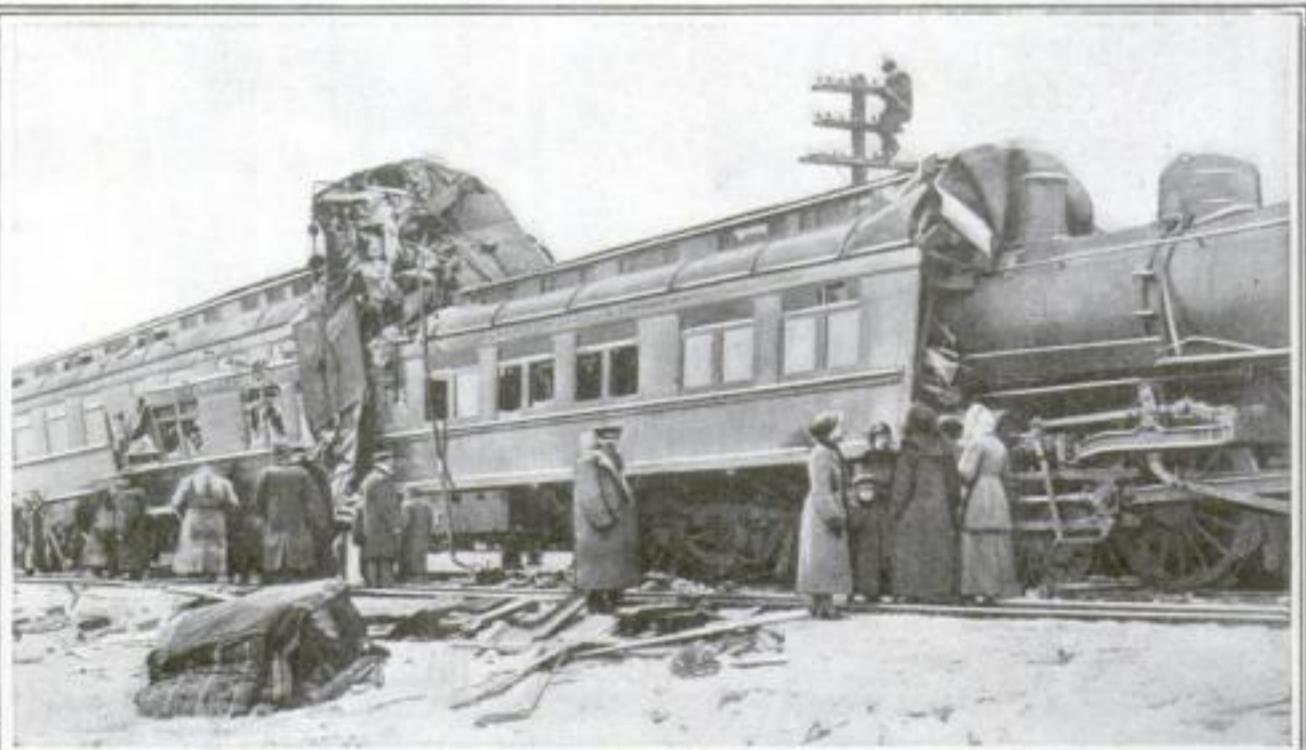
When two cars override, the floor of the first rises above that of the second, and the force of the collision pushes the rear car over the floor of the forward one like a plane, scraping off the entire superstructure and killing every passenger. Where the end of the car is caught and held within strong steel cables, the colliding car cannot rise from the track unless the cables burst, which is unlikely.

The cables have a combined tensile strength of two million pounds, and since this is greater than that of the center sills, the force of the initial impact in a collision is partly dissipated by crushing the vestibule, the area of destruction is confined to the vestibules, and the passengers are not endangered.

It is clear that this crumpling of the structure within the cables acts as a cushion for the shock, and before the cables part and the body of the car is invaded, the train which is struck will be forced away from further danger.



Where destruction starts. One car rises and usually overrides the next car



"Telescoping," translated into the terms of lost lives and irreparable damage, when steel crumples up and wood disintegrates into splinter showers. Cable-loop protection would have prevented this

Timing Concrete Mixing . Moving-Pictures of Vocal Chords in Action by Machinery

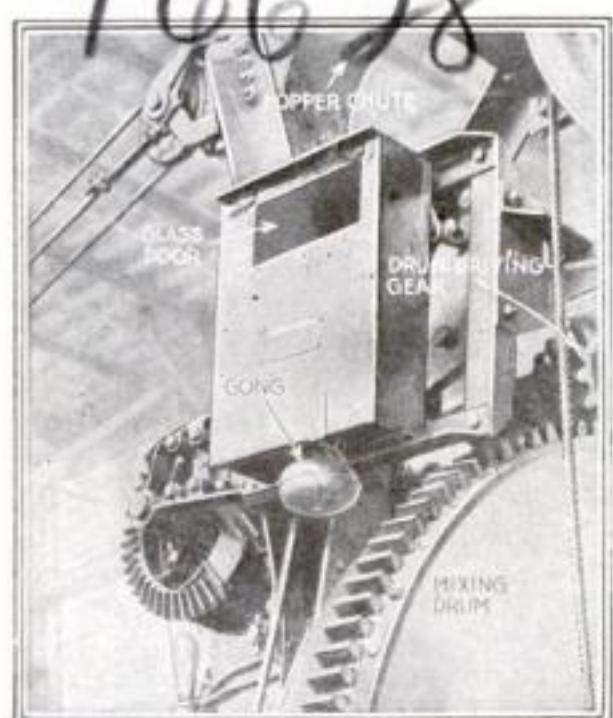
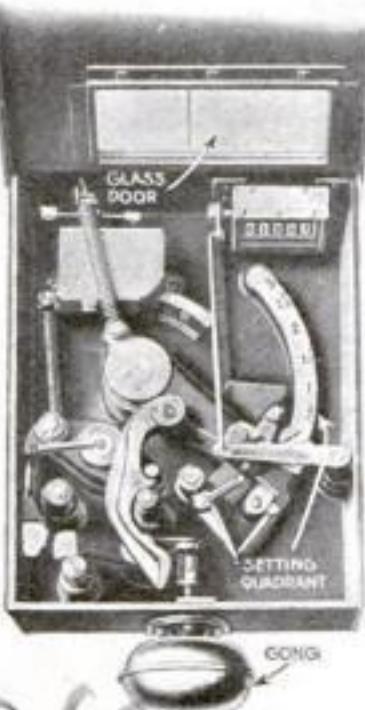
ONE of the important details in mixing concrete is that of keeping a batch at a uniform quality. Until recently this has been done more or less haphazardly. But now an instrument has been invented that automatically measures the time from the moment when the sand, cement, and stone are dumped into the mixing-drum until they are discharged from the chute into the forms.

Thus the mixing period is fixed, and the quality of the concrete is made uniform.

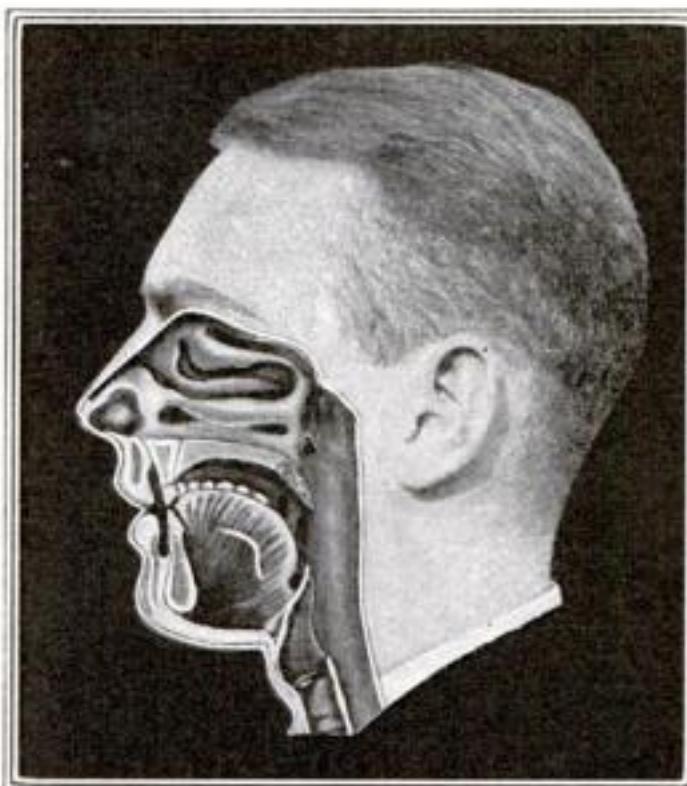
The apparatus controls the time of mixing through the medium of the discharge chute, which is automatically locked after the loading-skip reaches the charging position and the materials enter the mixing-drum. The chute remains locked until the specified mixing period has elapsed. No material can be discharged from the drum until the chute is automatically released at the expiration of the mixing-time. The end of

this period is signaled by a gong, which rings until the batch is discharged. The timing device can adjust the mixing period for any length of time from three seconds to three minutes.

The instrument also records each batch on a counter, thus providing a counter check on the number of batches mixed in a day and the amount of cement, sand, and stone used.



When the mixing period ends, the gong rings, the chute unlocks, and a standard batch of concrete is discharged



Courtesy of the Bray Studios

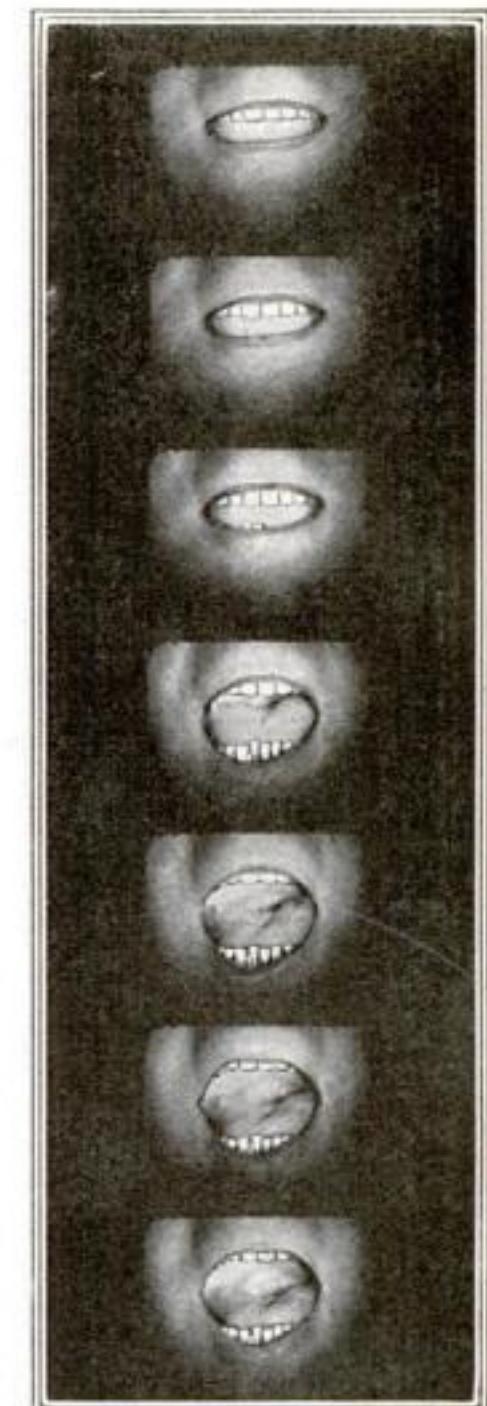
This is one of the many drawings made to show what happens in the throat and head when we sing

WHEN we sing or talk, air is ejected from the lungs and passes over the vocal chords, causing them to vibrate. Sound is produced thereby and it goes into the cavities of the mouth and nose, which act as a resonance chamber. The sound is then released through the lips.

By means of moving-pictures you can now see this process. Several hundred drawings like the one shown here have been made to demonstrate the various changes that take place while a note is sung.

The tongue and lips are very flexible and they change their shape readily in order to produce various letters. The vocal chords produce the tones; they are two folds of tissue with a V-shaped space between them. When you sing a low note, the space widens and the folds relax, and the reverse action follows a high note.

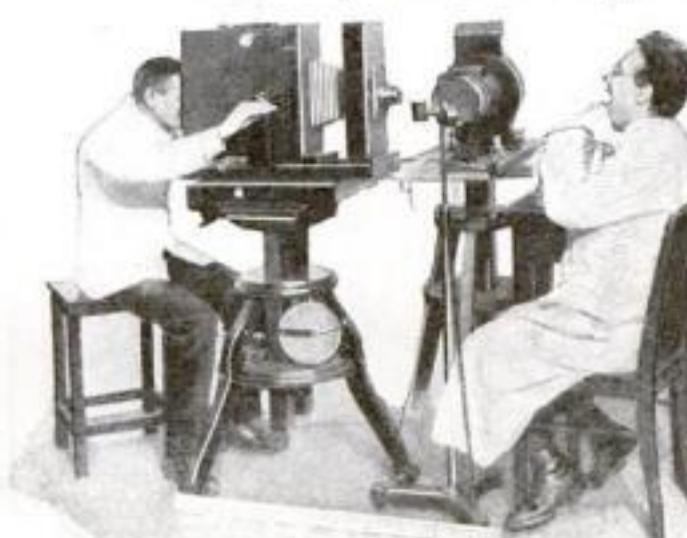
Professor G. Panconcelli-Calzia, director of the Phonetic Laboratory of the city of Hamburg, now photographs the throat in action. He places a long rod with a mirror at the end down the throat. By means of a light and a second mirror he is able to see the vocal chords.



Courtesy of the Bray Studios

This strip of film shows what happens when you pronounce "a," as in "father"

The number of vibrations in the chords when a sound is being made—100 to 1000 a second—is too great for an ordinary moving-picture camera to record individually; hence Professor Calzia and Professor Hegener have devised a rotating disk containing several radial slots. They place this disk between the camera and the throat under observation; light passes through it only when a slot comes into view. One out of every ten vibrations is registered. The motion is thereby plainly recorded and can be easily followed when the film is projected on a screen.



Taking photographs of the vocal chords in action. By means of a sort of periscope and a rotating disk every tenth vibration is recorded

17382

Correct Postures Aid

Why not learn to sit, stand, work and write in the best position?



The usual form upon which men's and boys' suits are made is calculated to fit the average person. It was formerly taken for granted that the average man or boy is partly round-shouldered, and suits were made that did not fit perfectly a straight form. Now there are other types of suit forms. On the left is shown how a suit built on a straight form projects on the neck of a round-shouldered boy. The right-hand picture shows how a round-shouldered suit fits the same boy.



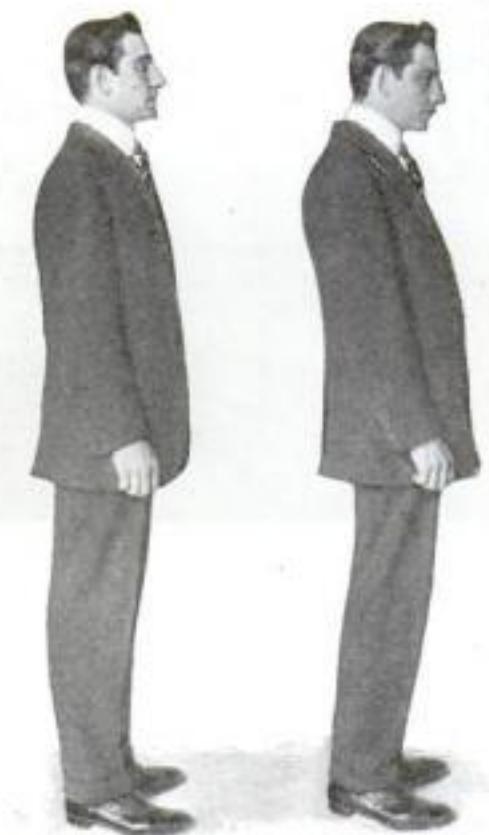
These men stood in a row after enlisting in the army. The photograph was taken through the courtesy of the United States Army officials at the barracks at Columbus, Ohio.



Here is the proper stool for factory workers, or workers at any bench or table. Its seat is adjustable and it has a foot-rest. Sometimes the foot-rest is placed on the work bench. The girl sits erectly and avoids unnecessary suffering from fatigue and eye-strain.



The girl worker in a factory is often obliged to sit on any kind of stool that happens to be in the stockroom. Seated on this, she bends over her machine in a back-breaking position that is likely to produce a permanent curvature of the spine.

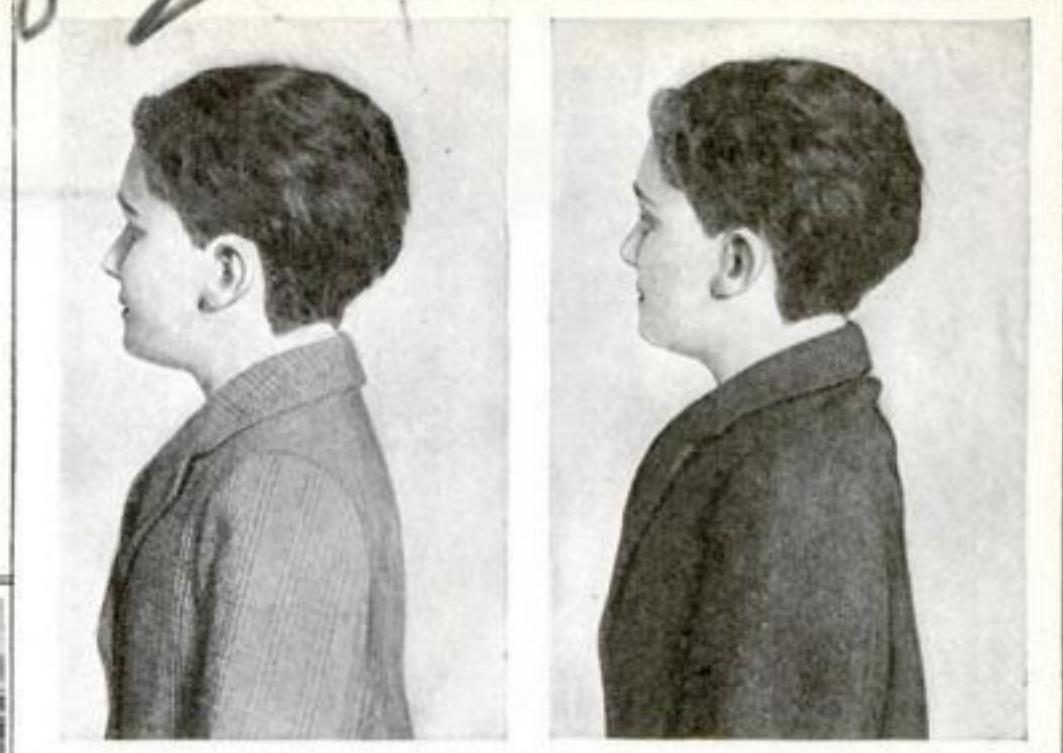


The man on the right is a good example of the wrong way to stand. His knees are bent and the shoulders cast down. The correct posture while standing is readily appreciated in the manly, erect figure on the left. It takes only a little practice to learn how to stand erect.

17382

Health and Appearance

The right way is as easy as the wrong and far more comfortable



Here are the same men after a few days' exercise. The erect figure in the proper suit shows how much better looking they are. Anybody who is not deformed can learn to stand straight

The American Posture League of New York has spent much time and effort in experiments to determine fatiguing postures. On the right in the picture above a boy who has learned to stand correctly is seen wearing a suit that was made on a round-shouldered model; on the left he is wearing a suit made on a straight model

The man on the right shows the correct way to hold a tablet in the lap to write on. Practise the correct way and note the difference it makes in your appearance



The wrong way to hold a writing tablet in one's lap. It brings the shoulders forward in a stooping position and produces eye-strain

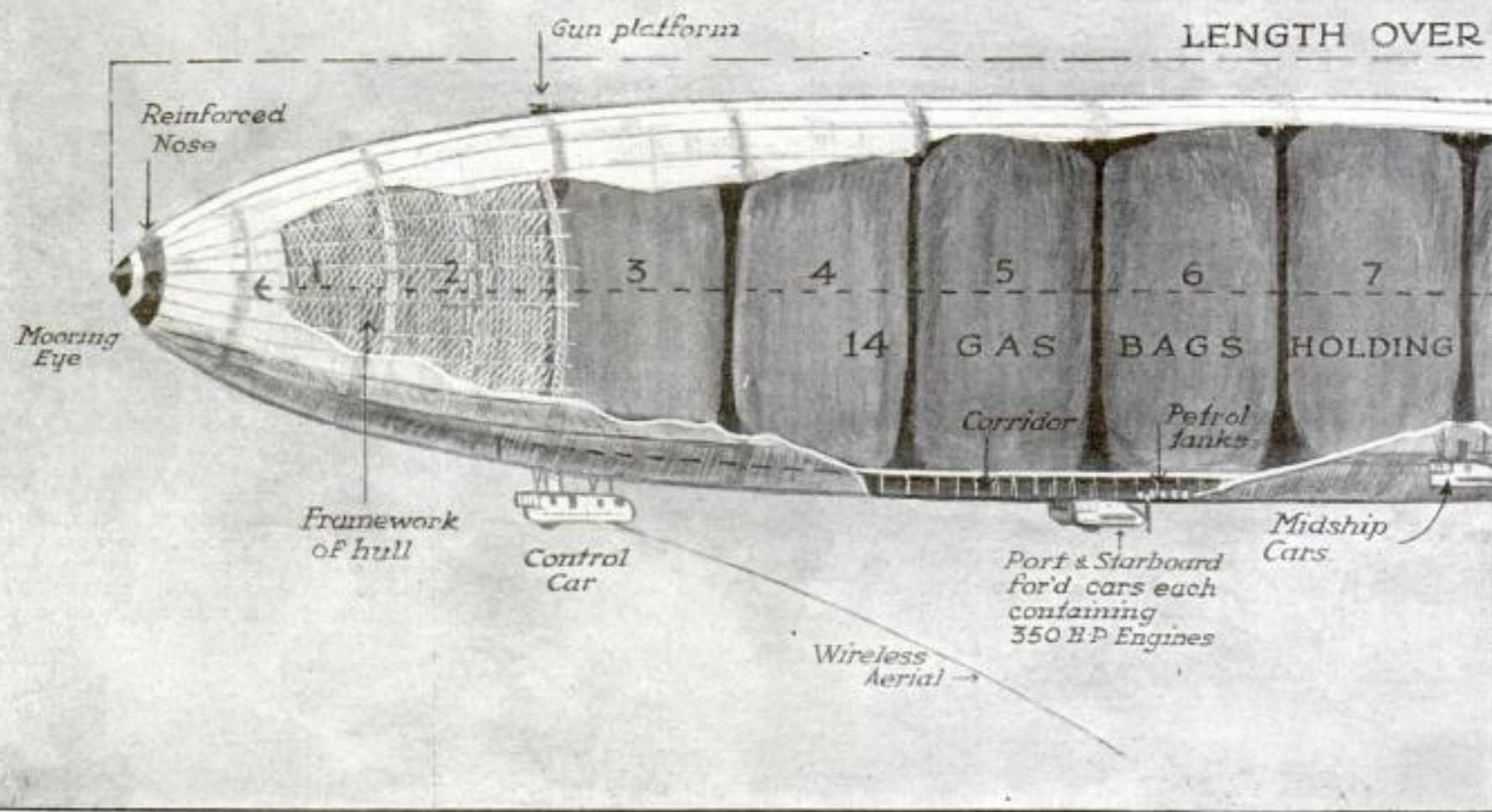


A ladies' tea-party is a good place to observe both correct and incorrect postures. On the right, in the picture, is the correct posture. Note the straight lines of the woman's figure. On the extreme left is the slouchy posture. The difference is in itself convincing

17461

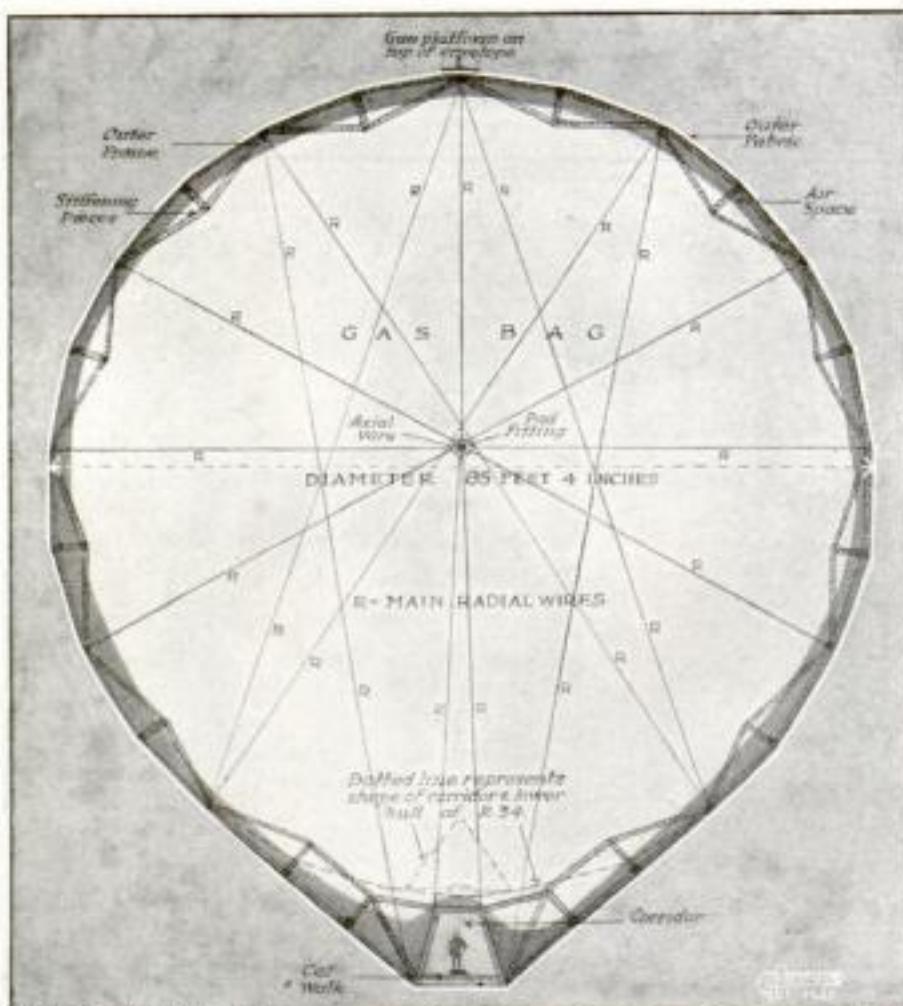


Underside view showing position of cars



© Modern Publishing Company

The nose of the ZR-2 (R-38) carries a conical mooring-eye that fits into a universal joint on the mooring-mast. The bow is reinforced with extra girders to withstand this strain and to prevent the nose from being blown in



© Modern Publishing Company

The girders are of duralumin, almost aluminum-light and steel-tough. Miles of wire are used in the internal braces that stay the rigid framework. Only the main radial wires are shown here

America's Largest

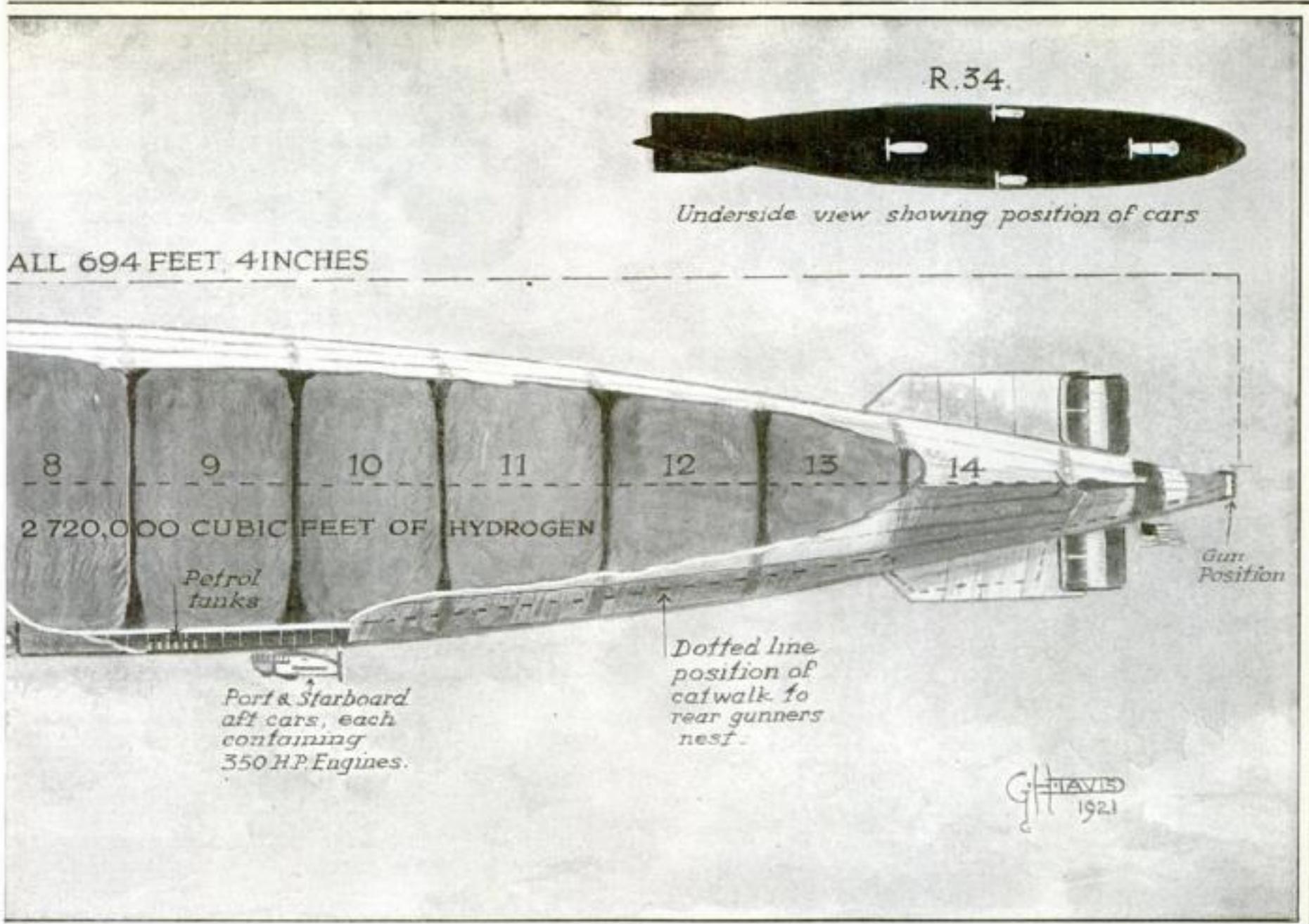
The ZR-2, built in England embodies many improvements

By P. J. Risdon, English Correspondent

THE British dirigible R-34, which was the first airship to fly across the Atlantic, is dwarfed by America's new airship, the R-38, built in England for the United States Navy. The R-38, renamed in the United States, the ZR-2, was the finest and most efficient military airship in the world on the day when it was being made ready for delivery to its Yankee crew.

The experience gained in flying the R-34 has led to many improvements in the construction of the ZR-2. The new ship is larger and more powerful. Its length of 694 feet exceeds that of the R-34 by fifty-one feet, the diameter of the gas envelope is seven feet greater, and the lifting capacity of the larger balloons is utilized in carrying more powerful engines, larger bombs, and a greater supply of gasoline.

An examination of the plans of the ZR-2 gives a clear idea of the newest developments in rigid airship construction. The stiff outer framework is built of lattice girders rigidly bolted together. These are made of an aluminum alloy called duralumin, which is almost as light as aluminum and nearly as strong as steel. Strong as this framework is, the air pressure against the vast hull is so great, particularly when it is



Aerial Battleship for the United States Navy not found in the famous R-34

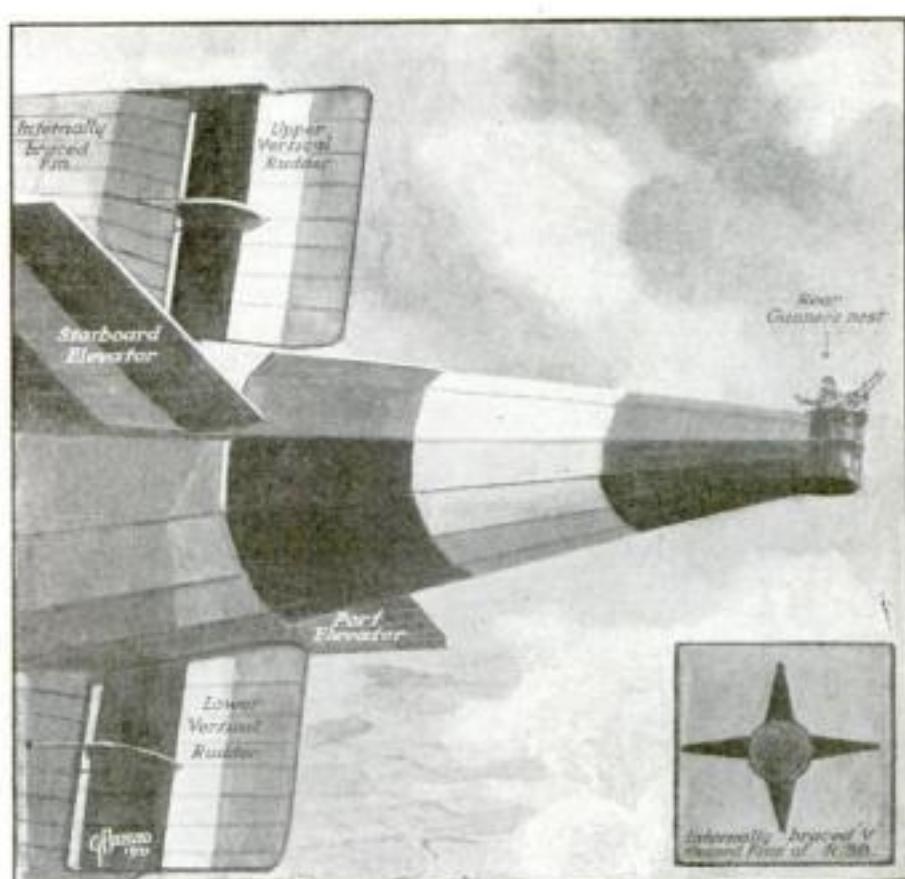
Drawings made by G. H. Davis

driven at its maximum speed of sixty-five miles an hour against a strong headwind, that the outer framework is reenforced by thousands of guy-wires. Of these, the central axial cable is the most important, since it runs from bow to stern through the gas-bags and strengthens the ship longitudinally. To this "keel" the other guy-wires are secured.

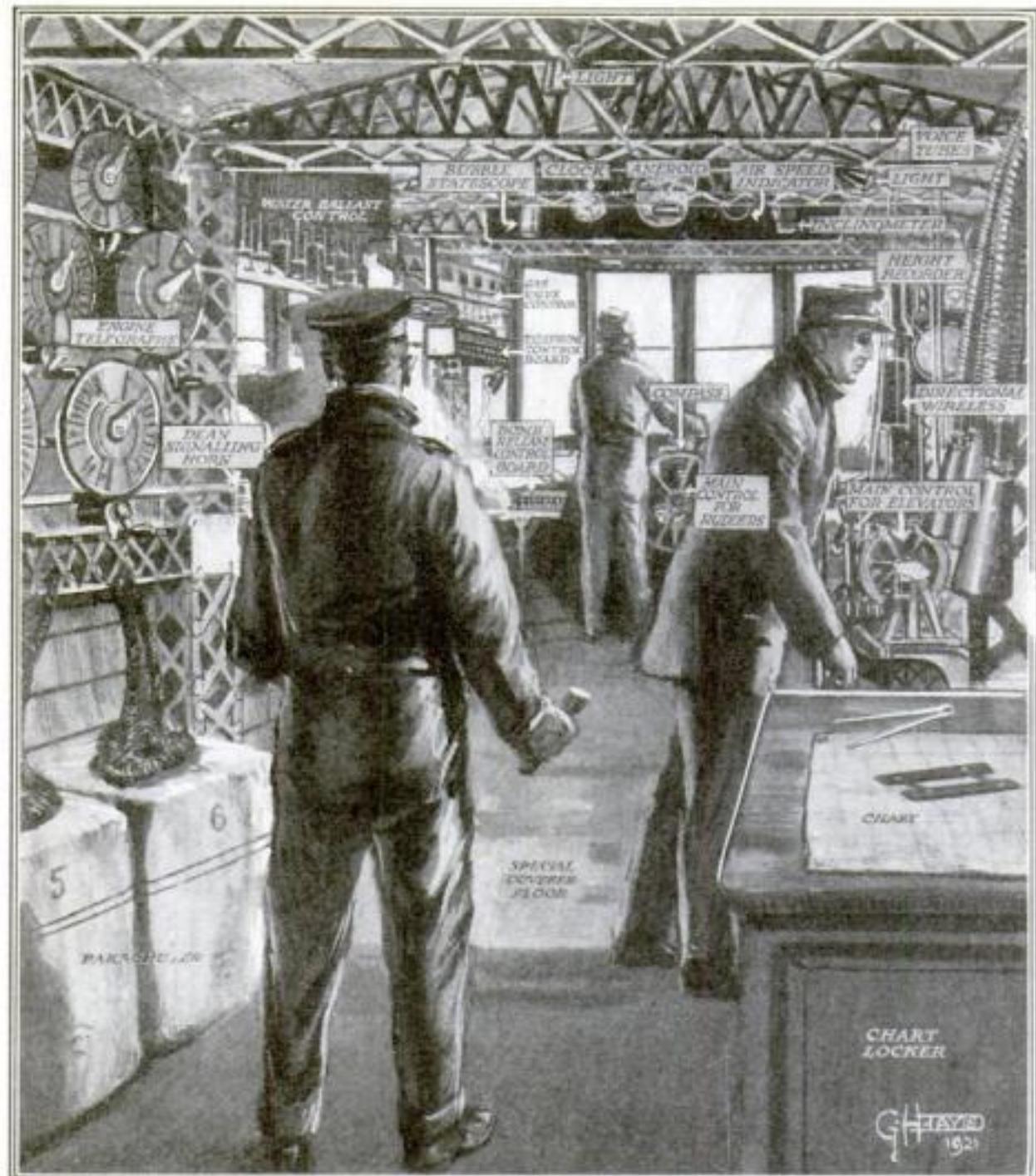
The duralumin framework is covered on the outside with three-ply canvas and rubber, laced on and doped to render it waterproof. The whole of the vast hull is then coated with aluminum paint. Experience has proved this very effective in reflecting the sun's rays so that the light cannot penetrate the fabric and damage the rubber, while by reflecting the heat of the sun the temperature within the hull does not fluctuate so violently.

There are fourteen gas-bags, which extend from the nose just aft to the rudder and elevator joints, the extreme ends of the ship having no gas-chambers. The twelve forward sections are forty-nine feet in diameter, the thirteenth is forty-one feet, and the fourteenth is thirty-three feet. All are fitted with an elaborate system of valves, and every precaution is taken to clear away the explosive mixture of air and hydrogen from

The maximum speed is from fifty-five to sixty-five miles an hour. The placing of the cars differs radically from that of the R-34. There are seven instead of four, and the flying controls are separated from the engines. The dirigible is propelled by six 350-horsepower English engines, four direct drive and the after two geared. The ZR-2 is considerably faster, carries more gasoline, and has a greater cruising radius than the R-34.



© Modern Publishing Company
Rudders and elevators are of the balanced type. Air pressure on surfaces lessens strain on the controls. The fins are V-shaped and internally braced in order to reduce air resistance



Here is the interior of the control car. The ZR-2 is steered by large wheels. All of these complicated instruments must be watched constantly, and frequent calculations based on their readings determine how to trim ship and maneuver for a landing.

the inside of the ship. To prevent all avoidable leakage, the gas-bags of the dirigible are of single-ply cotton fabric, the inner surface of which is covered with a single layer of gold-beater's skin.

Gas-Bags Alone Cost \$200,000

This skin is obtained from oxen. It forms an extremely light and efficient gas-container, but the supply of skins is limited, since only one can be obtained from each ox. Nearly six hundred thousand skins are needed to line the gas-bags of a dirigible of the R-34 class, and although the skins are worth only about three cents apiece, the amount of labor employed in scrubbing, cleaning, and applying them to the cotton fabric is so vast that the cost of the gas-bags alone is not far short of two hundred thousand dollars. A gas-bag will ordinarily last for two years.

The shape of the ZR-2 differs from that of the R-34 owing to the extension of the lower bays of the envelope frame, which gives the ship a more oval appearance. The arrangement of the cars on the under body is the

result of experience gained in flying the R-34. This ship had four cars, each provided with a motor. The ZR-2 has seven, six of which are "lower cars," while the seventh is used solely to house the controls.

This is an advantage for exact navigation. The R-34 had a big car forward, or rather two cars joined together but divided by a space of one inch. The forward car held all the delicate control apparatus, and when the engine in the rear car was running, the vibration and noise inconvenienced the navigation and control officers, who were separated from the engine-room only by an inch of air space.

In the under body of the ZR-2 the control car is placed as far from the engine as possible. The nearest engines are the port and starboard fore-engine cars, which are far enough away to insure silence for the control car. All these cars are placed very low on the hull. The control car and the fore and aft pairs of engine cars are provided with "bumping-bags," or shock-absorbers, since they rest on the ground when the machine lands. The two midship cars are slung

higher up the side of the hull, so that their propeller blades are clear of the ground when the bumping-bags of the others are resting on the earth. To prevent damage to the propellers of the lower cars, they are arranged so that when the ship is about to land, two blades of the propeller can be automatically held horizontal and thus clear the ground.

The great vertical rudders and elevators are controlled by wheels in the control car. These are similar to the ordinary ship steering-wheel. The one on the right hand, looking forward, controls the elevators, and the other in the nose of the car actuates the vertical rudders. The ZR-2 is so large and the size of the controlling surfaces at the stern of the ship so great that new construction methods were adopted.

The ZR-2's Rudders Are Unique

They were made in the shape of fins, following the design of the latest Zeppelins, and instead of bracing them externally, as in the R-34, all the supports are internal. This makes the outer surface of the V-shaped fins perfectly smooth, reduces the air friction, and enables them to withstand far greater wind pressure than the narrow, externally braced fins of the R-34.

The "cat-walk" is a narrow passage leading from the radio-room in the control-car clear aft along the bottom of the framework. It is so called because it is only twelve inches wide.

Several of the gasoline-tanks are what is known as "slip-tanks." If it is necessary to lighten ship suddenly (as is frequently the case) these tanks can be thrown overboard. The cooking apparatus and the bunks for the officers and men are also located along the cat-walk.

A speed of sixty-five miles an hour is attained by the six 350-horsepower engines. Four propellers are direct connected, and two geared.

A formidable craft in warfare will be the ZR-2. With its armament of fourteen Lewis guns and one one-pounder automatic, the big airship will have an effective reply ready for attackers and a means of leaving its mark on water craft below. One of the Lewis guns shoots downward from the center of the under side. Another is planted on the stern. The one-pounder is mounted in warship style on a *tourelle* that raises or lowers it so that it can fire directly up and virtually on a straight line. But the ZR-2 carries her chief sting in her bomb-racks, where four 520-pounders and eight 230-pounders are held on a trigger release ready to deal destruction to unlucky ships steaming beneath, ships whose speed the great dirigible can easily double.

Keeping in Touch with the World while Camping

SHOULD business or pleasure take you out in the wilderness, beyond the reach of mail, telegraph, or telephone, you need no longer be isolated on that account. A portable wireless equipment, invented by a German electrician and so compact that it will not be a burden on a long journey, will enable you to remain in touch with the world and to exchange telephonic messages with your family, friends, or business associates.

For greater convenience in carrying, the apparatus is packed in two parcels. One of these contains the folded frame and support for the antennae wires and greatly resembles in appearance a folded camera tripod. The other parcel is a box with a strap handle and contains the wireless apparatus for receiving and sending and the telephone earpieces, which are held in position over the ears by a spring strap.

With this apparatus, communication over a considerable distance is possible and the messages may be in telegraphic or in telephonic form. One of the illustrations shows the apparatus in use on a boat floating on



Though many miles from the nearest post-office, telegraph, or telephone station, the man in the boat is in touch with his family and the rest of the world by means of his wireless equipment

When packed, the apparatus case resembles a camera box

the quiet waters of a lake. But it may be used anywhere else—on a railway-train, in the mountains, or in the desert.

Put the sections of the antenna frame together, stretch the wire or wires over the cross-arms, and mount the frame on its support. Then open the instrument box, make the wire connections and place the telephone receivers over your ears. Give the code signal of the station with which you wish to communicate and wait for an answer. If your instrument and that of the receiving station are properly attuned, you will not have to wait long for the answering signal and then you may telegraph or telephone to your family, to your friends, or to your office, receive the latest news from the stock exchange, and send your instructions perhaps for closing some important deal.



By moving the rod of this instrument to correspond with letters on a card, you can learn to play

A Simplified Trombone

HERE is a wind instrument that slides in trombone fashion and yet is very easy to operate. You blow—not too strenuously—through the mouthpiece and slide a telescoping rod backward and forward to get various tones. The letters of the scale—written in the key of F—are marked on the main tube, thus you can teach yourself how to play with the aid of an indicator attached to the sliding rod.

The music is written in letters corresponding with the letters of the key. By moving the rod so that the indicator corresponds with the letters on the card, you play the tune.

WE want every reader to profit from the scores of "useful things to make" described in "The Home Workshop" (see page 80). With a few tools—and Popular Science—you can enjoy one of the most fascinating recreations, and add to



The electrical floor-groover automatically cuts a slot from one eighth to five eighths of an inch wide

Electric Floor-Groover for Interior Wiring

AT the Chicago post-office all mail cases are connected with electrical floor boxes. When the location of a case was changed, it formerly was necessary either to tear up the floor or saw by hand a slot large enough to accommodate an electric feed wire. This laborious task is now performed by means of an electrical floor-groover, which cuts a slot automatically and at a great saving of time and labor. Grooves ranging from one eighth to five eighths of an inch in width may be cut.

A man operates the hand wheel, which automatically feeds the cutter as the groove is made.

the convenience, comfort, utility, and efficiency of your surroundings. We also call attention to the fact that a total of \$165 in prizes is offered monthly for the best contributions in connection with the department.—The Editor.

Factory-Built Houses Help to Solve the High-Rent Problem

Ninety thousand can be built every year

By James Henle



Every part of this beautiful little house was completed in the factory leaving nothing to do but assemble the parts on the foundation

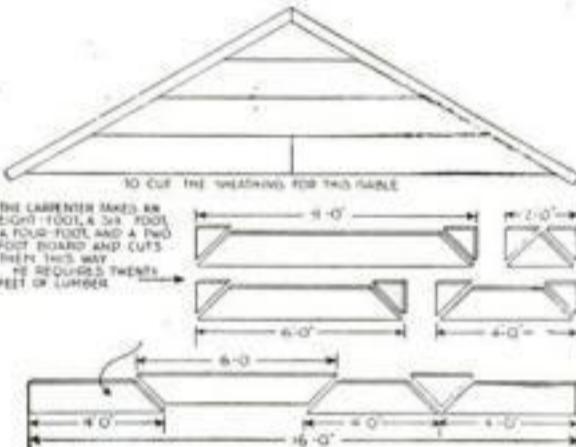
FACTORY-BUILT houses that can be turned out by the dozen in big shops undoubtedly offer one solution of the present housing problem. Not only are they less expensive than handmade houses, but they can also be made in a very short time. At present there are twenty "house factories" in the country, and their aggregate capacity is three hundred houses a day—more than ninety thousand a year.

When you order a house, it is delivered to you in pieces that are ready to be nailed together. The pieces that make up a five-room bungalow, for instance, would cost less than two thousand dollars, delivered. The putting together and finishing off would cost about fifteen hundred dollars. Thus your entire house would cost thirty-five hundred. Furthermore, the companies that turn out these houses

To thousands of readers longing for their own homes, this article will bring vitally interesting news.

It reveals the rapid strides of a new national industry which is applying factory methods to the production of houses.

The industry described in these pages seems to offer one solution of the problem, since it puts within your reach a variety of new houses that represent a saving of about 30 per cent. over a similar dwelling built in the usual way.



Scientific cutting, as shown directly above, uses sixteen feet of lumber where the carpenter would use twenty feet

offer easy-payment plans that make it possible for every man who is earning even a moderate salary to own his own home.

These houses can be heated by steam, hot water, gas, or any other method you may prefer. They have modern plumbing,

electric light, and every convenience found in an up-to-date house. It is impossible, merely by looking at them, to see how they differ from houses on the same street put up by individual contractors.

In a fairly typical instance—this of the ready-cut house—the foundation sill, floor-joists, sub-flooring, the regular tongued-and-grooved flooring, the studding, the wall sheathing, the siding, the window- and door-frames, the outside finish, rafters, roof sheathing, steps, stairs, and the porch framing are delivered to you already cut and ready to nail into place, also the fittings



When you buy a ready-cut house, it is delivered in this manner. Each piece is numbered ready to be nailed into place. The carpenters need no saws. A factory-built house can be erected in from five to ten days

and materials needed for completing the building—the building-paper, lock-sets, door-hinges, window-weights, nails, paints, varnishes, etc. This is not a new way to build; it is much the way in which Solomon's Temple was constructed; and, in another sense, it follows the methods used in erecting the modern skyscraper.

No one familiar with the fundamentals of modern industry will find it hard to understand the economies that, aside from the saving in expensive hand labor, come from the quantity production of houses. In the first place, quantity buying of lumber by the factory permits the purchaser to escape paying the middleman's profits. Machine labor in an up-to-date plant can do better, faster, more accurate work than hand labor, no matter how skilful the artisans are individually. Mill preparation of lumber permits economy of cutting. With lumber prepared by the factory method, only the parts that are actually needed are shipped to your lot.

An Architect's Services Free

The houses are designed by highly paid expert architects, but the expense is spread over so many houses that the actual cost to each purchaser is practically nothing, and thus he is saved the fee that he would have to pay an architect for designing an individual dwelling for him. Systematized factory methods in handling and shipping lumber prevent loss of time and labor, just as in a modern clothing factory it is possible to produce a suit of clothes at a lower price than a single tailor, performing all the operations himself, can do it.

It is difficult to say just how great a saving this amounts to in dollars and cents. Apparently it may amount to as much as 30 per cent of the cost of



This bungalow represents a new idea in factory-made houses. Its walls are completed at the factory, and it comes to the consumer ready to be bolted together by a patented method. The house is just as substantial as are those made in the conventional manner

the house. For instance, an Eastern house factory manufactures a Colonial house that costs \$3835, or, with masonry, foundation work, plumbing, heating, lighting, etc., about \$7000. It is difficult to see how this house could be built by a contractor for less than \$10,000.

This brings in another element. The prices quoted by the various plants generally do not include any of the items enumerated above. As a rule, these add 30 or 40 per cent, or even more, to the catalogue prices.

A point that must not be forgotten is that in a comparatively inexpensive bungalow the "extras" run proportionately high, but that in more expensive houses these "extras" do not constitute so big a factor in the total cost. For

kind of competition. It is doubtful whether there is any industry in which the manufacturers are more intent upon getting as much business as possible and in keeping down their prices so as to attract the greatest volume of sales. Most of these plants have permanent forces to which they attempt to give regular employment. They can reduce their overhead expenses only by increasing their output.

The various plants have different methods of selling. A large proportion of them depend upon mail orders, but at least one important organization sells only through local lumber dealers. In the same way there are different methods of delivering the houses. For the most part, ordinary railway freight is used, but some firms, which confine their sales largely to one section of the country, employ motor-trucks and send their own men along to put up the structure. Another plant sends a foreman to supervise the work of local carpenters. Some concerns state that skilled labor is not necessarily required for erecting their houses. In any event, purchasers should ascertain in advance whether labor to erect their homes will be available.

How Long It Takes to Build

Depending upon the size of the house and the degree to which it has been completed when it leaves the factory, it requires from a few days to a month to erect and make ready for occupancy one of these quantity production houses. However, even the ones that consume the most time are ready in a fraction of the time required to build a house by ordinary methods. To an individual this may or may not be important; but to a company building many houses at once, this means that a great deal



Inside a house factory. Here the sawing and planing-machines shape boards and rafters that will be used in house construction

instance, the excavation work for a bungalow must be just as extensive as that for a two-story house of seven or eight rooms, and in other respects the costs for the smaller house are larger in proportion than they would be in a more pretentious dwelling.

Buyers of quantity-production houses will find that the firms in this industry are engaged in the keenest



Carpenters cannot compete with machines. A humming circular saw will rip through twenty boards in the time a carpenter is sawing one

is saved in interest on the money invested.

The remarkable extent of the industry is shown by the fact that there are plants manufacturing houses in every section of the country, in the East, on the Pacific Coast, in the South, in the Middle West. Their products appeal to the well-to-do, to those of moderate means, and to large corporations seeking housing accommodations for their employees.

The products of these companies range from a two-room cottage of insignificant cost to large residences which, when completed, cost over twenty-five thousand dollars. The number of styles offered runs into the thousands, and, if you cannot be satisfied even by this wide choice and wish to add individual features of your own, it is possible to obtain modifications of existing designs at only a trifling additional expense.

The man who is now paying rent would do well to carefully consider the question of what he gets for his money and whether it is really necessary to pay rent for thirty or forty years or longer and then at the end have nothing to show for it. For instance, a man paying fifty dollars a month rent can buy a six-room house that completed will cost about five thousand dollars.

If a man owns a lot and can make an initial payment of about one thousand dollars on his house—and in some cases this figure can be reduced—he often will be able to arrange, either through the company from which he buys his house or through a building loan association, to pay for his house on easy terms. If he puts in only the fifty dollars he has been accustomed to pay every month for rent, he will be able to pay off his debt and to own his house at the end of nine years.

No one who deals with one of the large, reputable companies engaged in this industry need fear that, because the transaction takes place largely by mail and freight, he will not receive the personal attention to which he is entitled. These concerns depend upon satisfied customers to make other sales.

Have You Seen the New Steel House?

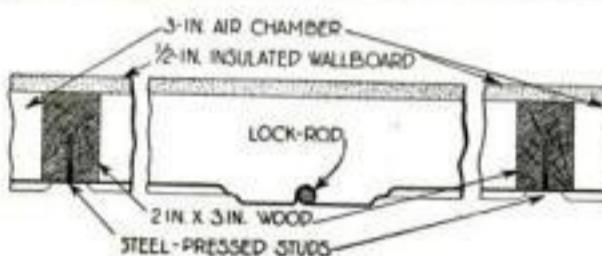
A small house recently put on the market is made of steel in interlocking sections that are assembled into per-

How Factory-Built Houses Differ

THE ready-cut house reaches its purchaser in lengths of timber cut to size. Skilled carpenters are required for building this type of house.

The ready-built house comes in complete units which have been finished at the mill and can be put into place by the average purchaser without the assistance of a carpenter or builder. Thus the floor, windows, doors, walls, ceiling, and roofs all are shipped in easily assembled units, which means a great saving in labor cost to the purchaser.

Factories making either type of house, however, are able to show many economies in the selection and cutting of material which the individual builder could not begin to duplicate.



Showing how the steel-covered house is erected. The company supplying the house takes care of its construction, and there is therefore no worry about the labor question

manent buildings without piercing the metal and without the use of screws, nails, or bolts of any kind. These houses are lined with insulated wallboard designed to render them warm in winter and cool in summer. The claim is also made that these homes are practically fireproof and that lightning will not injure them.

One of the typical cottages sold by this company is twenty by thirty-six feet and contains a living-

room, two bedrooms, kitchen, and bath. The steel siding is embossed, panelled, and painted and gives the effect of stucco. The roof is covered with steel having the appearance of attractive red Spanish tile.

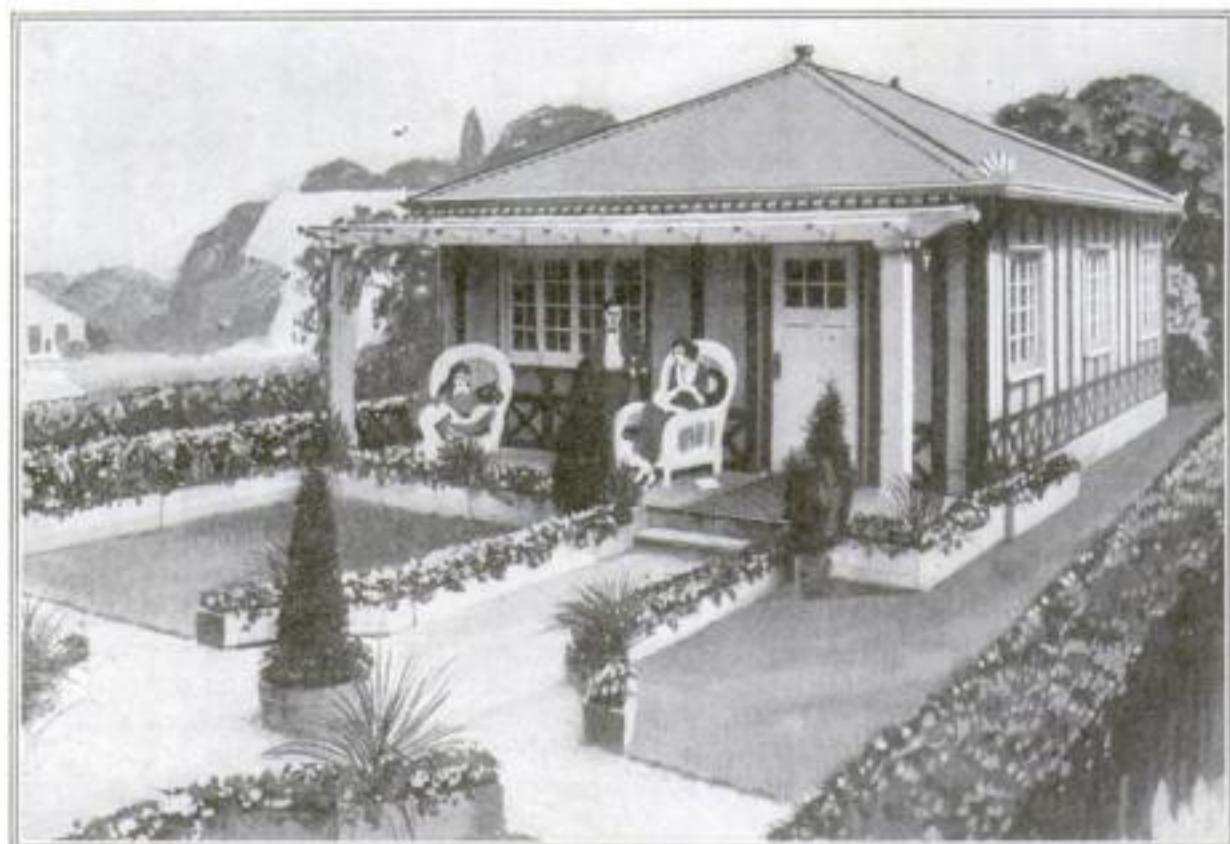
This house sells for \$1985, which includes everything except heating. Persons who do not want to pay cash are offered their choice of two easy-payment plans. Under one

of these they pay \$985 and the rest is included in a three-year mortgage. Under the second the initial payment is only \$385 and the remainder is paid in forty monthly installments of \$50 each, which cover the principal and interest on the unpaid balance. The company is also selling lots to those who have no land of their own.

Many Styles Built from One Unit

From the same unit other and more elaborate styles of homes can be constructed. The only limit upon the variety of these is that the width of any unit cannot be more than twenty feet, due to the fact that the roof and walls are constructed as a single, interlocked whole.

In short, it is possible to satisfy almost every variety of taste in the matter of what a home should be, by one or another of these factory-built houses.



The steel-covered house enters the field of ready-made houses. The picture above gives a clear idea of the steel roof's appearance. Sheet steel has

been used extensively in the construction of factories, but this is the first time it has been pressed into service for house-building purposes

Air-Bags and Wheels that Drop Enable Land Plane to Rest on Water

IN case of trouble over water the airplane shown below can be made seaworthy very quickly. To do this the pilot simply pulls a few cables and turns a few valves. The landing-wheels are the first to go; they are literally blown off their hubs. The pilot pulls a cable that draws two safety coppers within the main pins. Then he turns a compressed-air valve that sends air through the axle and off are blown the wheels.

Next he pulls a cable that rips open the fastenings of the canvas covers in which two air-bags are enclosed.

Turn of the compressed-air valve fills them with air. These bags are attached to boards on the under surface of the lower wings.

There are three air-bags inside the fuselage that are also blown up to give the airplane greater buoyancy. The machine is then ready to land on the water.

There is a wooden hydro-surface in front of the wings that hits the water first. It supports the weight of

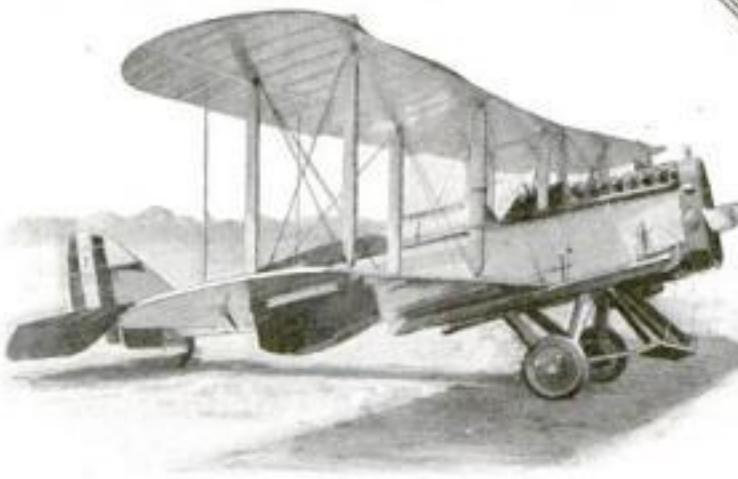
Courtesy U. S. Air Service



the airplane and prevents the bags from being torn loose as the airplane speeds through the water on landing. There is also a tail hydro-surface; this prevents the "ship" from "nosing over" as it lands—the tail is forced to stay in the water.

Wooden pontoons of the usual design are attached to the lower wings.

If necessary, the airplane can float on the water for several hours.



By pulling cables and turning valves the pilot can change this land plane into a seaplane. The landing-wheels are blown off by compressed air.

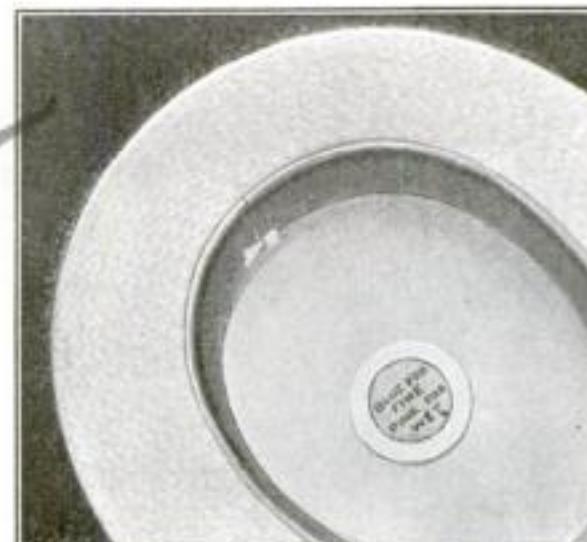
With air-bags filled, the pilot can taxi up to the beach, pull a couple of fresh wheels out of the cockpit, attach them and take off overland again.

A Weather Bureau in Your Hat

EVERY one hates to carry an umbrella, yet every one hates to be caught in the rain with a perishable straw hat.

You can, however, take a look into your hat and get a real prognostication—if you have the right kind of hat. This is a hat beneath the crown of which is pasted a disk of blotting-paper that is blue when clear weather is promised, pink when rain is due.

This result is obtained by treating the blotting-paper disk with a solution of one part of cobalt chloride, ten parts of gelatin, and one hundred parts of water. Cobalt is extremely sensitive to variations of moisture in the atmosphere, and, thus used, makes the hat a weather bureau.



The little disk tells you whether your hat is likely to be rained on or whether the sun will continue to shine.



With this American woman's color orchestration, we may play lullabies to rest tired eyes as well as tired ears



Playing Music with Light Doubles Your Enjoyment

MUSIC has been given an interpretation in color. Mrs. Mary Hallock Greenewalt, a noted pianist of Philadelphia, has added color to the charm of music. She believes that we may have "notes" in light as well as notes in sound. We may also artistically blend various wave lengths of light just as we blend wave lengths of sound. The blending of beautiful shades of color with music gives to the music a new artistic effect.

In the case of sound we have disturbances in the air. With light we have wave disturbances in the ether. The pitch of a certain sound depends upon the wave length. The high note on a piano vibrates several thousand times a second, and the last bass note vibrates very few times a second.

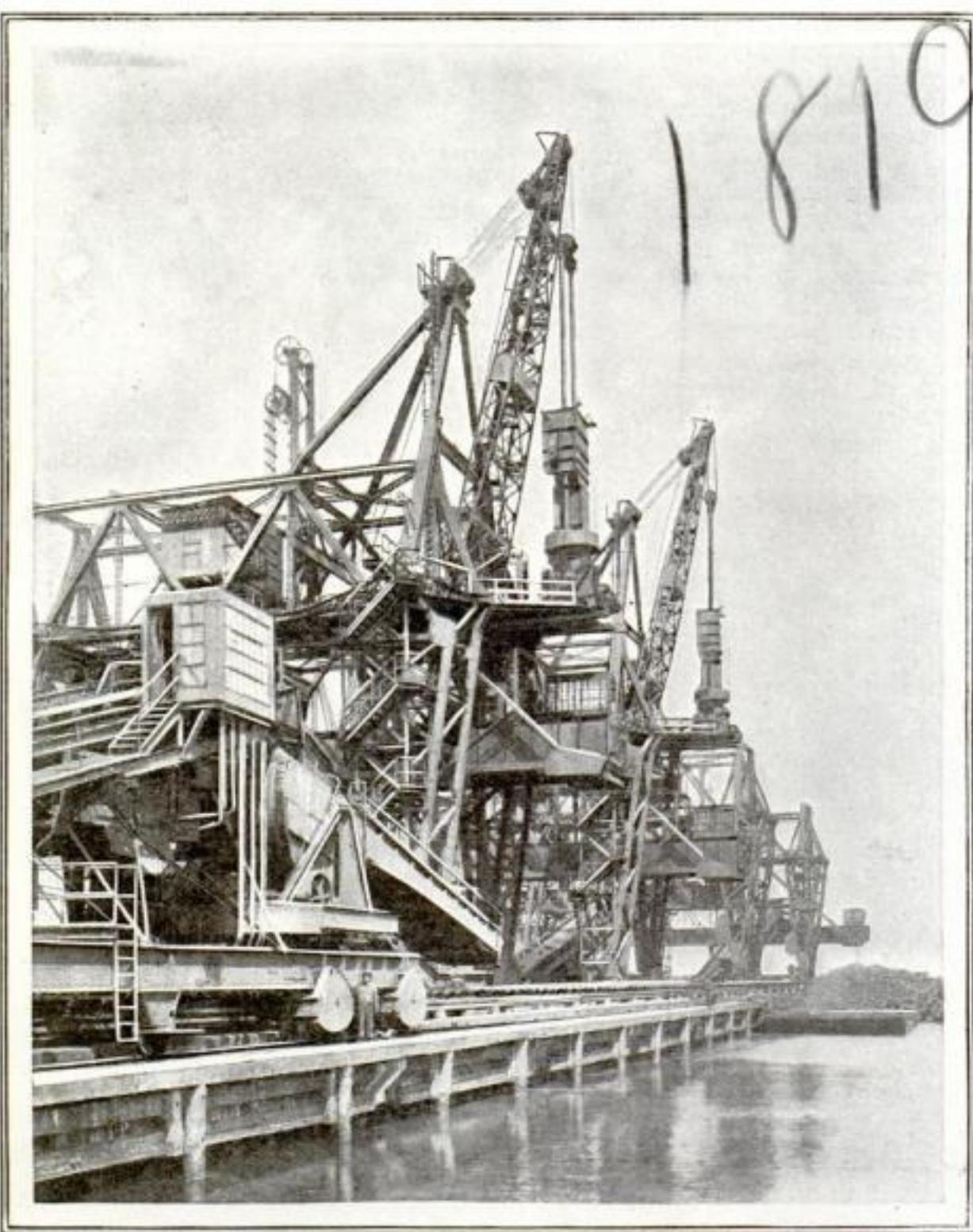
There is a scale of light waves ranging from a very high pitch to a low pitch. In the case of light waves, however, we have vibrations in the ether that reach several billion a second. By

arranging certain colored lights in the order of their wave lengths, we may produce a chromatic scale that may be used in connection with the music scale.

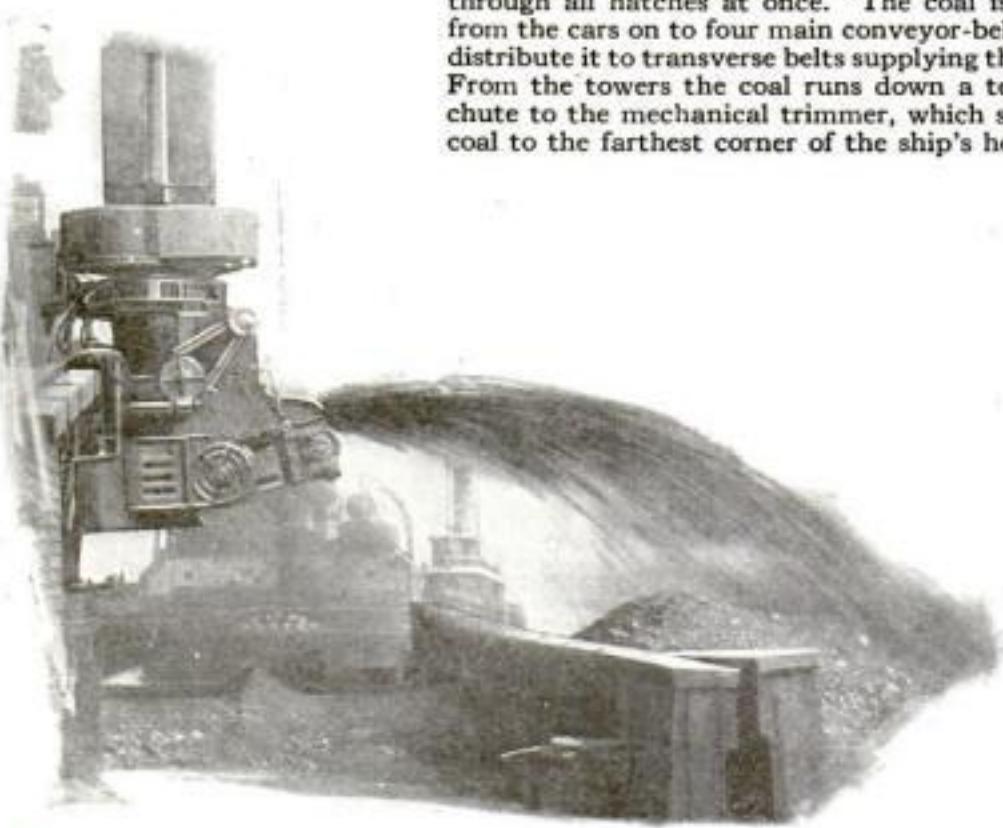
This is just what Mrs. Mary Hallock Greenewalt has done. She has arranged a color scale that may be used with music scales.

Mrs. Hallock Greenewalt employs a single lamp in connection with specially constructed resistances, so that the intensity of the light may be varied progressively. A revolving color-filter is placed before the lamp, and the motion of this is controlled by the operation of the rheostat. The entire outfit is used as an adjunct to a regular orchestra equipment.

Coaling Ship with a Mechanical Trimmer



A battery of trimmers ready to load a collier through all hatches at once. The coal is dumped from the cars on to four main conveyor-belts, which distribute it to transverse belts supplying the towers. From the towers the coal runs down a telescoping chute to the mechanical trimmer, which shoots the coal to the farthest corner of the ship's hold.

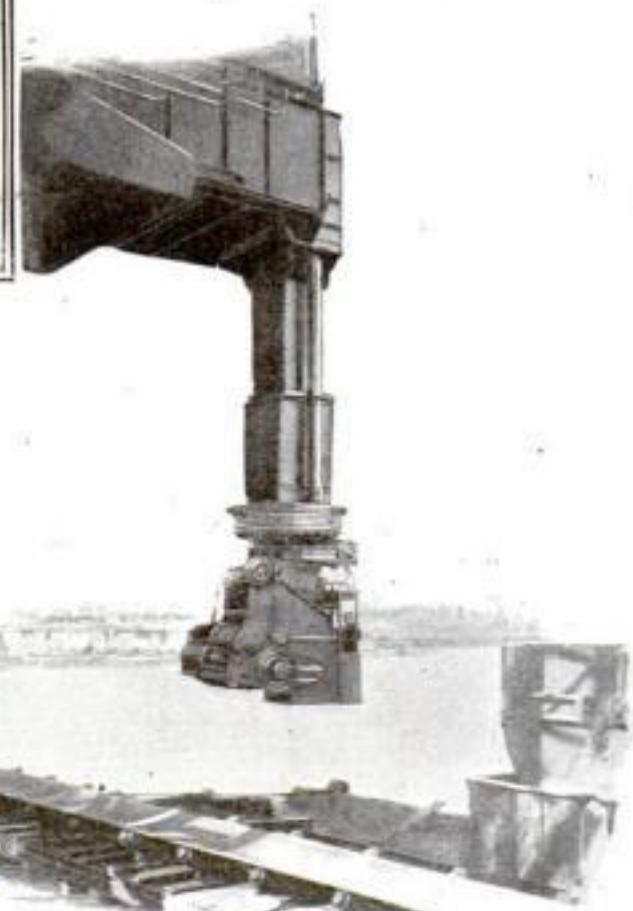


Each minute twenty-five tons of coal are thrown thirty feet by a cleated belt running at a velocity of twenty-seven hundred feet a minute

ONE explanation of the mysterious sinking of the collier *Cyclops*, which disappeared without leaving a trace after sailing from Brazil in 1917 with a war-cargo of manganese, is that the cargo suddenly shifted in a gale and capsized the vessel. Sea-captains always insist that men "trim," or distribute cargoes of coal evenly and solidly, into every nook and corner of a vessel's hold, so that, no matter how widely a ship rolls, the coal will not be able to gather into a heap at one side. Trimming is an essential precaution; but it is a dirty, slow, laborious, and expensive job.

Now the Baltimore & Ohio railroad has installed a mechanical trimmer that at its export coal-pier at Curtis Bay, Maryland, loads a collier with scientific exactness in an exceedingly short time. Instead of a gang of men working below decks in a fog of coal-dust, there is only one man, and he does not touch a shovel.

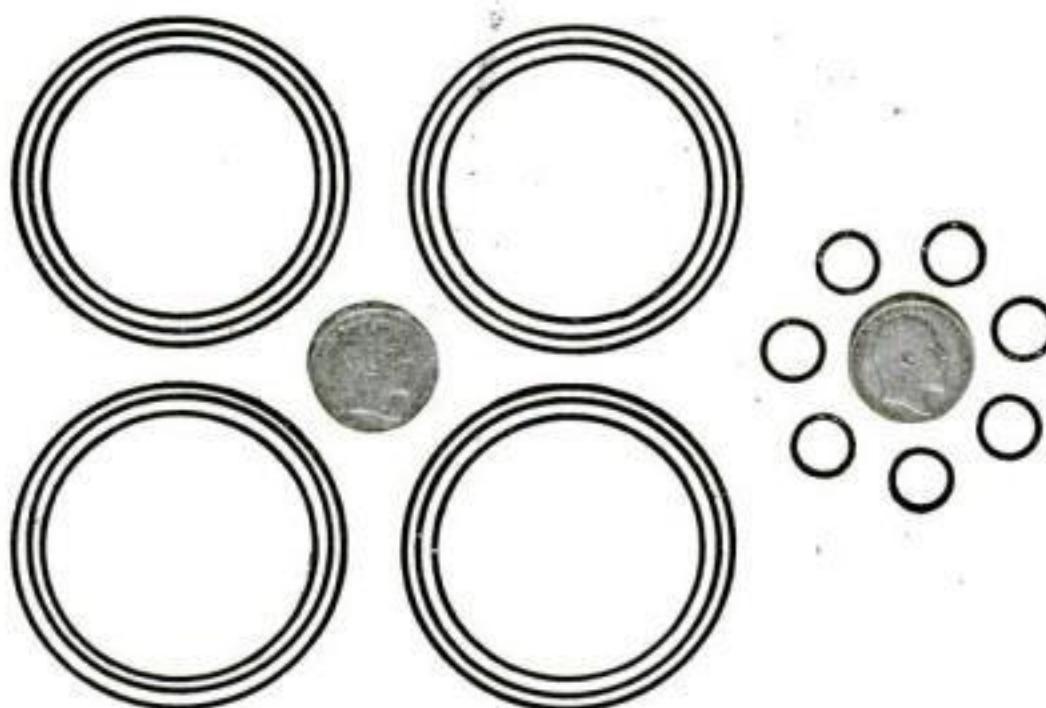
Belt-conveyors carry the coal from the cars to the trimmer. Here it falls on to a belt moving at a rate of twenty-seven hundred feet a minute, and the cleats on this belt throw the coal nearly thirty feet, packing it evenly into every corner of the ship's hold. The result is a large increase in the handling capacity of the coal-pier and safer and more compact stowage.



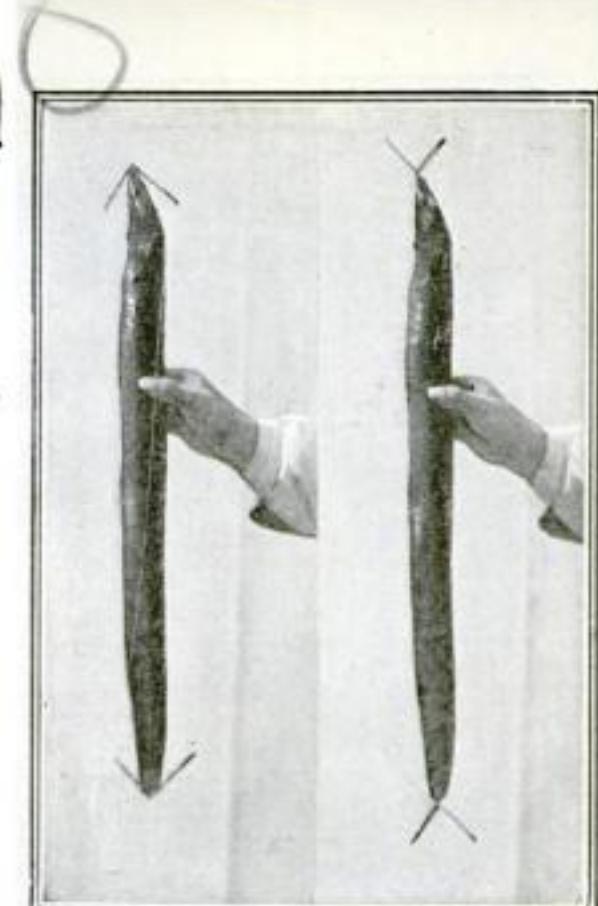
The trimmer weighs twenty-two tons, but will be lowered into the hold in four minutes. The operator's position is in the rear of the trimmer, and he is lowered below decks with it to superintend the loading. The trimmer turns on its axis to place the coal evenly throughout the hold.

Some Interesting Eye Tests: Try Them

You will find that things are not always what they seem

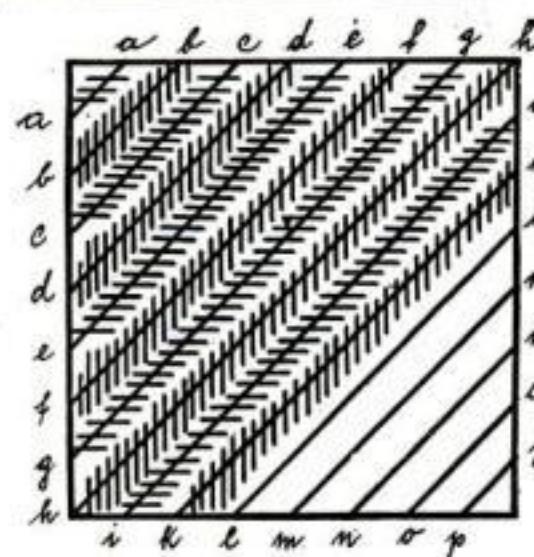


Look at these two coins; they have the same design, but are they of the same size? One is surrounded by large circles and the other by small. Solve the mystery yourself

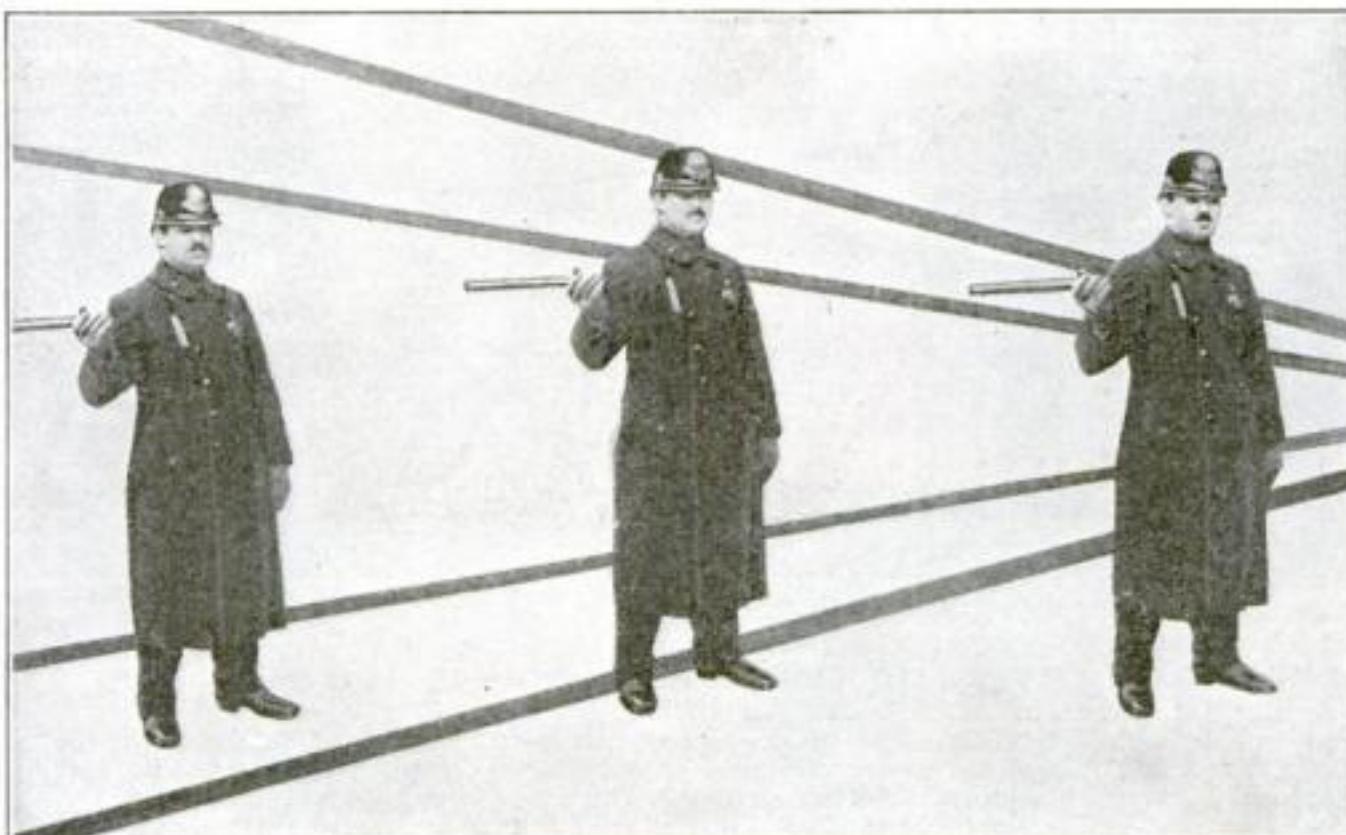


These are eels. If you could have either one at the same price, which would you choose? But don't decide definitely that one is larger than the other until you have actually measured them with your ruler

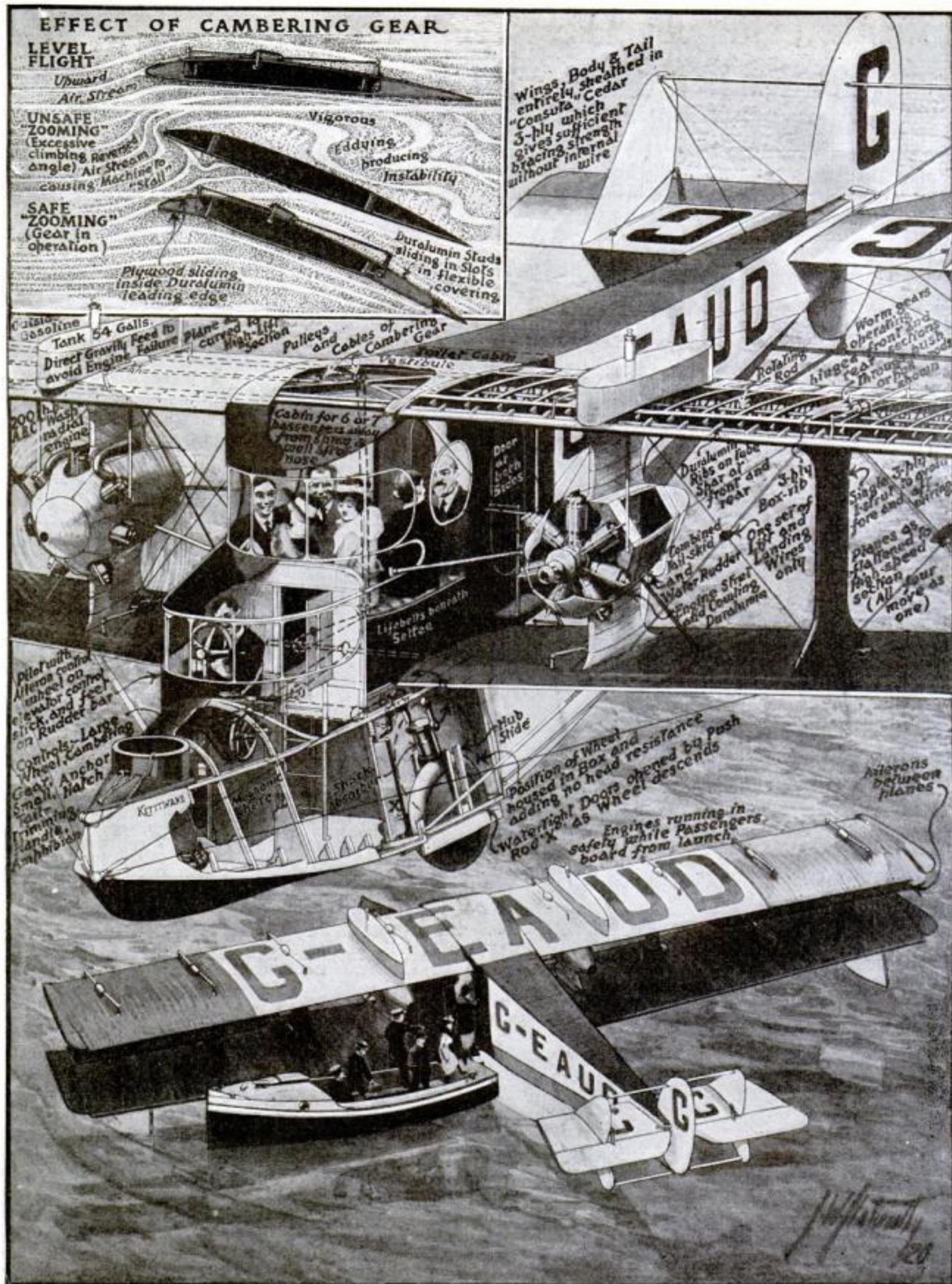
Have a cigar. One is held vertically and the other horizontally. Our eyes are more accustomed to traveling horizontally than vertically. Bear this in mind when you consider the length of these cigars



Are the lines that run diagonally across this square parallel or converging? You will need your ruler again before you decide. Those short vertical and horizontal lines that cut the diagonals are misleading



Here is a picture of three policemen, all dressed alike, looking alike, and standing in the same position. Is it possible that the three pictures represent one man? The right-hand man may seem larger than the other two—you'd better measure them



© Modern Publishing Company

Drawing by S. W. Clatworthy

A Yacht that Travels on Sea, Land, and in the Air

THIS monster hydro-airplane has a pair of landing-wheels hidden in the hull; they add no head resistance during flight, and yet they can be lowered in a few seconds if an emergency landing is necessary. The slope of the planes is variable in order to facilitate a short rise, slow landing, or high speed in flight.

The passengers sit in a comfortable enclosed cabin. The boat hull itself is easily detached in case of a leak,

and a "spare" hull can be substituted, thus avoiding the necessity of laying up the entire machine while the leak is mended. The wings, body, and tail are made of plywood instead of fabric; thus internal wiring is unnecessary. There are four struts between the planes on each side, and they are also made of plywood. Only one set of lift and landing wires is necessary. The machine will make one hundred and ten miles an hour.

Ninety Feet Down a Twenty-Inch Hole

When he got down that far, he signaled for a hammer, rock-drills, dynamite, and some fuses

STANDING on a small platform suspended at the end of a rope, Mr. O. C. Stout, of San Angelo, Texas, was lowered through a hole barely as wide as his shoulders into a huge cavern below the surface of the earth.

He continued down and down through space—some ninety feet—playing his flashlight on the weird rocks and strange earth formation around him, until his feet struck a projecting ledge. This was what he was looking for. He signaled the men above to stop. Except for the twenty-inch hole—which might have become clogged by falling earth—he was buried alive.

What was the cause of this strange descent? Oil.

Stout was at that time connected with a company that was drilling for oil. He was driving the cutting-bit through sand and rock when, suddenly, the drilling cable acted strangely—it was not hitting properly. He realized that the bit must have gone through too large an opening. The bit had then struck a ledge and had been thrown off its straight course. And the cure for this was the removal of the ledge!

Mr. Stout had been a miner in his earlier days and offered to go down the hole. The rope that was used in lowering him was attached to the sand line that runs over a pulley in the "crown block" of the derrick. Stout had arranged a set of rope signals with the men who were to do the lowering.

After he reached the ledge he signaled for a hammer, rock-drills, dynamite, and fuses. With only his flashlight to guide him, he drilled two holes in the ledge. In these he placed the charges of dynamite that were attached to the ends of a stick. Next he adjusted the fuses, braided the ends together, and fastened them to the stick.

His work done, he signaled the men above to haul him up.

How to Light the Fuses?

Standing erect on the small platform, he held his body motionless during the long ascent; if he had moved ever so slightly he would have begun to swing from side to side, pendulum fashion. At last he reached the small hole through which he had come, and in another moment he was outside the earth again.

Then came the problem of lighting the fuses. This was solved by lowering



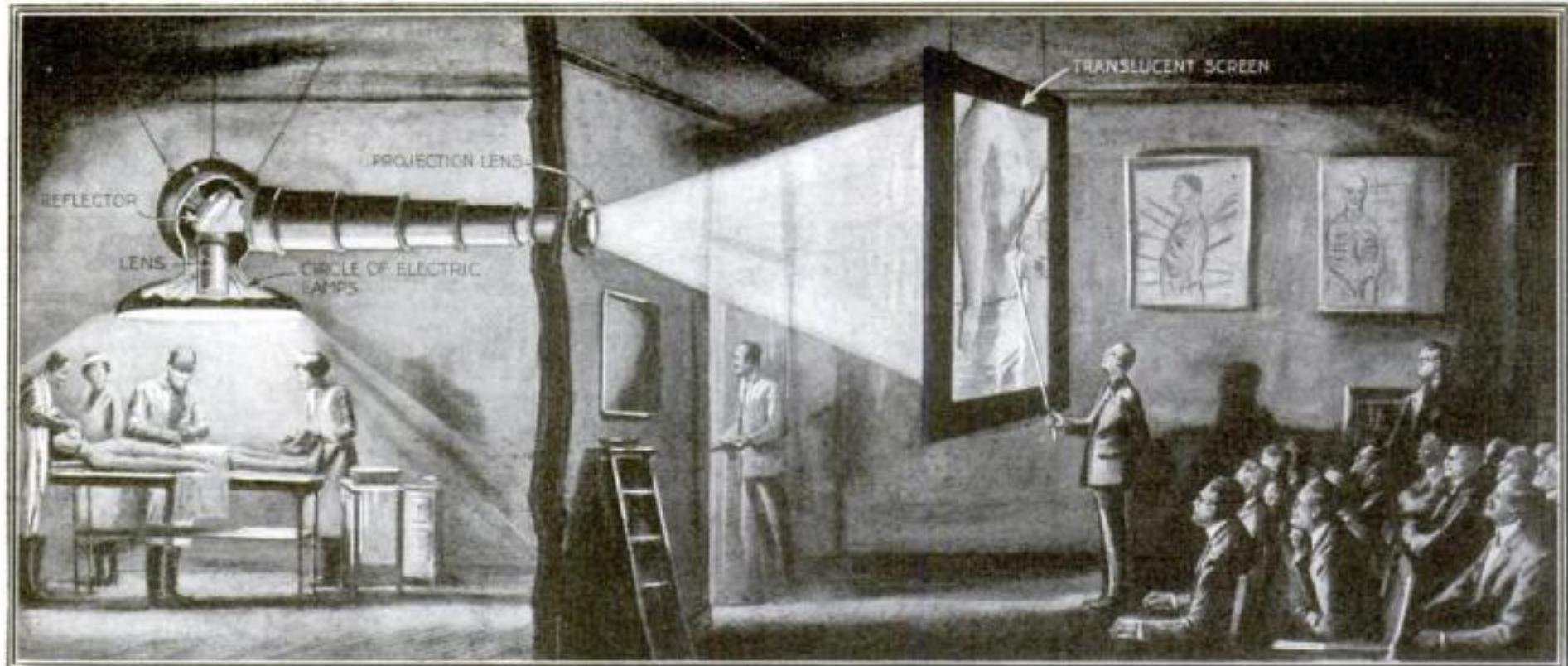
They were drilling for oil. When the cutting-bit had gone through some ninety feet of sand and rock, it began to act strangely. It had struck a ledge, and the only remedy was to remove the ledge. O. C. Stout volunteered to go down and investigate. A platform was secured to a rope, and standing rigidly on this he was lowered into the hole, which was only twenty inches wide. When he reached the ledge—but read the story yourself

a lighted candle through the hole. It ignited the fuses, and soon after the low rumble of the underground blast was heard by those above.

Mr. Stout's work, however, was not yet done. He made two more trips down the hole in order to clear the debris out of the way and to hang a plumb-line.

While he was down there he investigated the cave of which the ledge was a part, and found that it extended deep into the earth. A brave man, you say. And yet he was quite unconcerned about his strange trip, considering it but part of the day's work.





An Operation Performed in One Room Reproduced in the Next

HERE is a new way in which to carry on a clinic. By using the observation instrument invented by Herbert A. Silver, of Cincinnati, students in another room are enabled to follow every detail of an operation.

One advantage of this arrangement is that the instructor can easily follow the movements of the operating physician and comment freely on them for the benefit

of students. The instrument could be also used by an employer to observe the industry of his employees in the workrooms while he remains in a private office.

The device is in the nature of a periscope combined with an illuminating lantern that throws a light on the screen of an enlarged view of the field of observation that it covers.

Unfurl the Sail and Ride on the Life-Belt

THE function of an ordinary life-belt is to keep you on top of the water—it gets you nowhere. But a new life-belt has been invented that will carry you through the water; it is equipped with a sail and also with a propeller, which you operate by hand. If you see a far-distant shore at the time of shipwreck you have at least a chance of reaching it.

The life-belt itself fits around the neck. A metal ring is attached to it, and from this ring hangs the propelling device. You sit astride a metal bar and turn a handle that operates the propeller. If there is a strong wind blowing in the direction in which you are traveling, it will be wise to erect the small sail that is attached to the belt proper. This sail will give you speed and will also enable rescuers to see you more readily. The propelling handle will keep you from becoming numb.

Mr. Marcorelli, a Frenchman, is the inventor of this traveling life-belt.



This life-belt is equipped with a hand-driven propeller and a sail, which enable the user to travel through the water



Fireproof Hollow Bricks Cheaper than Lumber

IN some parts of the country the bricks here pictured are cheaper than lumber, better than ordinary brick and hollow tile, and save one third of the cost of material and labor over a solid brick wall eight inches thick.

Moreover, the bricks are so dry that plastering may be done directly upon the inside surface without the necessity of furring.

Breaking the mortar joints, none of which penetrates the wall completely, confines the moisture to the outer veneer, and the air in the interior chambers absorbs this.

The bricks are laid on edge, each brick thus affording a gain of twelve square inches of wall space, or eighty-three and one third square feet to each thousand bricks.

Builders claim that for fire resistance, strength, and cheapness no other wall construction at present on the market can equal it.



These bricks can be laid on edge very effectively. They are hollow and are said to be fire-resisting, strong, and cheaper than lumber

Destroying the Corn-Borer that Destroys Crops

European corn-borers ruin the life of an ear of corn. They bore through the stalk, then through the husk, and finally tackle the ear itself. As many as fifteen full-grown borers have been found in a single ear of corn



These are full grown larvae; they were about to spin their cocoons inside an ear of corn when they were found. They spin near the surface of the stalk, so that the future moths, on emerging, will have no difficulty in flying away. The moths themselves are harmless; it is the larvae that do the damage



Steaming is one of the methods used in destroying borers. Here you see some men pulling a canvas cover over a pile of infected stalks in preparation for the steaming process



This is the boiler that creates the steam that kills the borers. The coal-bin is seen to the left. Both of them are mounted on a platform that can be wheeled from place to place with ease



Burning the stalks and stubble by a gasoline flame is the cheapest way to kill borers. This truck carries a large gasoline-tank, and travels from field to field, delivering the gasoline



Borers breed so rapidly that unless 95 per cent of them are killed each year, conditions will be no better the next year. Gasoline flame should be used in badly infested districts. When the corn is but slightly infested it can be used as fodder



Here you see the stubble being plowed up prior to burning. It is collected into piles and then sprinkled with gasoline. It insures quick destruction of this pest that was not known in the United States before the year 1917



He Sheds His Antlers Once Every Year

ONCE a year elks shed their horns. As soon as the old ones are gone new ones start. This process is repeated every year, the only difference being that an extra prong appears each time. Thus you can tell an elk's age by the prongs in one of his antlers.

The shedding is apparently a painless occurrence. As an antler falls off, a clot of blood forms at its root. In the first six months of growth there is a soft skin over the antlers; this is known as the velvet. As long as the velvet is there the antlers remain somewhat soft and sensitive, but when the velvet peels off the antlers become hard and dry up, and they lose all feeling.

Lifeboats Made of Basketwork

ROTTERDAM sends us this novelty in lifeboats. It is the invention of Mr. De Vos of that city. The model differs very little from the standard lifeboat in outline. But from that point all resemblance ceases.

The boat is lined with cork and covered with basketwork, including the fenders. This construction insures the boat against being overturned or crushed against the sides of the ship and permits of carrying a full complement of passengers with a greater margin of safety than is the case with ordinary lifeboats.



This basket lifeboat comes from Holland



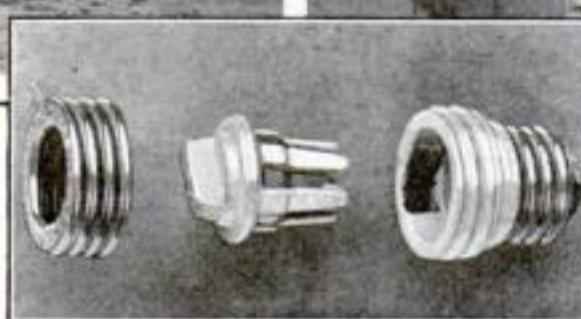
© Kadel & Herbert

Seamen's Institute Memorial to the Ill-Fated *Titanic*

THE building containing this binnacle is a memorial to the steamship *Titanic*, that majestic palace of the sea that went down on her first voyage after colliding with an iceberg.

This binnacle is arranged on wheels so that it may be turned in various directions. This helps the student navigator to find himself, and much practical information on navigating is obtained in this way. Turning the wheel turns the platform carrying the binnacle, and this corresponds to the turning of a ship.

The compass is mounted before the dry-land navigators in the usual way. The only thing lacking is the rolling of the ship.



This Fuse Can "Blow" Six Times

ELECTRIC fuses act like safety-valves on steam-boilers—they "blow" when the current becomes too strong. Fuses are made of strips of alloyed metals with low melting-points. They are made to form a part of the electric circuit.

A fusible element of a certain size allows a certain amount of current to pass. We can imagine a water-pipe built so that it will allow a certain amount of water to pass without bursting. When too much current passes through a fuse, the alloy becomes hot and melts, and the electric circuit is broken because the fusible element no longer completes the path of the current.

The fuse shown contains six elements, and when one of them blows or melts, a twist of the little handle will place another one in circuit and current will flow again.

DON'T throw away old carbons until you have tried the following rejuvenating process: place two sheets of fine paper face to face, put a sheet of ordinary paper over them, and press with a warm flatiron.

Solving the Spare-Bed Problem

MOST settees that can be converted into beds look the part; you can spot them immediately. The one shown below, however, is different. It is made in an entirely new manner. The back and side arms pull out and become the foot of the bed; the seat turns over and reveals the hidden mattress and bedding beneath.

The two sections—back and seat—are joined together and have a common spring that flattens out when the sections are unfolded. The entire bed, when extended, is four feet wide and six feet long. When closed it looks like an innocent and comfortable armchair.



An extra bed such as this is invaluable



Hide the 'Phone Behind a Mask

JUST why a telephone is kept under cover in the best families, we do not know. We suspect, however, that the general lines of the instrument do not please the eye of the sensitive.

In the picture above you see the head of a Japanese wind god; beneath it is the telephone. The receiver is tucked behind the god's right ear and is easily removed when the telephone bell rings.

The mouthpiece is inside the ear, and the woman talks into it just as if the god were a deaf old man.

Your Body's Repairing Power Can Now Be Tested

THE cells of your body are constantly being built up and destroyed; this process is known as metabolism. And if the two processes are not approximately equal, disease will follow. For instance, if the body takes in more water than it throws off, dropsy results. Therefore it behooves us to know the state of our metabolism.

The picture below shows a machine for testing it. The patient breathes through the nose into a rubber hose. The gases pass into tubes and then into jars. The amount of carbon dioxide is automatically measured.

If it is below or above the usual amount, precautionary measures are taken.



Her repairing power is being measured



Fire-Ladder Wheeled by Hand

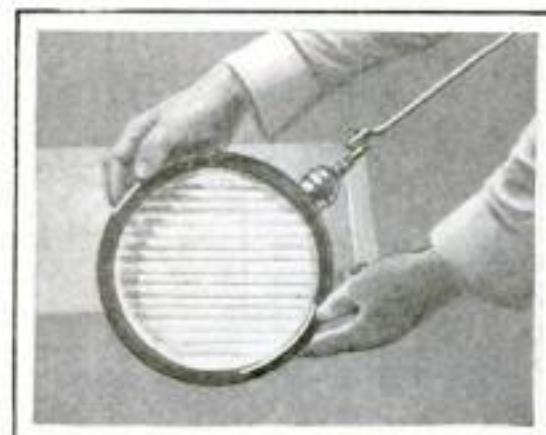
NOW the hook-and-ladder truck has a rival; Hubert Hopkins, of the San Francisco fire department has invented a ladder that can be wheeled through the streets and erected by two men.

The ladder is mounted on a small frame to which wheels and handles are attached. When the ladder arrives at a fire, the wheels are raised and hooks are used to make the ladder firm. It is then extended to the desired height.

This Dimmer Reflects Light

AUTOMOBILE headlights at night are courteously dimmed when passing another machine; otherwise the glare would dazzle the driver.

Ordinarily the dimming is done by turning off the bright lamps and turning on lamps of lesser candlepower. But here is a new method. Inside and across the glass front of the headlight are tilted metal strips. They are highly polished and are spaced so that the lamp can be seen, but some of the light is cut off.



Here is a "close-up" of the dimmer



Protecting the Movie Actor

MERCURY vapor arc lights are used in movie studios. These are long glass tubes that give a greenish-blue light.

This light is harmful to the eyesight; so, while the actors are at rest, tinted goggles are placed in the eye-holes of the odd-looking dress shown.

The dress is to slip over the head of the actor to save him from the ill effects of the heat given off by the lights. It has a special crown sewn in the top to act as a reservoir for a hair preparation that counteracts the drying effects of the heat.

Apparatus for Making a Sheep Take Its Medicine

RECENTLY the Bureau of Animal Industry of the United States Department of Agriculture rigged up the outfit shown below for administering medicine to sheep suffering from stomach trouble.

Copper sulphate solution is fed from an elevated reservoir—in this instance a galvanized bucket—to a rubber tube and then into an open graduated glass tube. Measured doses escape through the rubber tube to a metal tube in the sheep's mouth.

The flow into and out of the glass tube is regulated by pinchcocks, one man attending to this while another holds the tube.



This device regulates the medicine dose

**An Appetite Gage**

OUR bodily temperature depends on several things. The most important thing is food. After we eat a heavy meal our temperature rises. It is like shoveling fuel into a furnace. More fuel, more heat.

The "hungryometer" is made up of a coiled thermometer arranged in a case that will slip into the vest pocket. It keeps tabs on the heat of the body. When the temperature falls below a certain point, it is time to eat.

Unfortunately, the thing does not tell people when they should stop eating. If it did it would be of far greater value than it is.

Realistic Miniature Highway

A MINIATURE of a picturesque mountain route in California has been constructed on the lawn of a Los Angeles home.

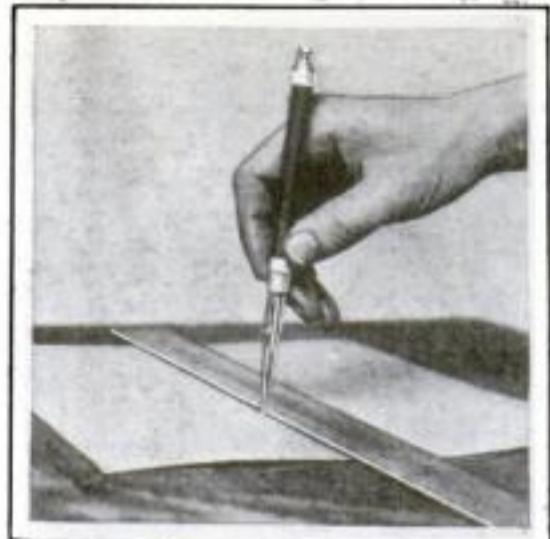
The miniature road is made of concrete and winds in and out over and between grass-covered mounds. At one point it crosses a model railway which emerges from a tunnel in the side of a miniature mountain.

Realistic features have been added to the tiny highway, including signs at the railway crossing and at "dangerous" curves. The children take great delight in pushing toy vehicles over the winding road.

Vegetation May Furnish Motor Fuel

FUEL alcohol to be used in automobiles may be made from the moist vegetation of tropical jungles, according to H. N. Whitford of the Yale School of Forestry.

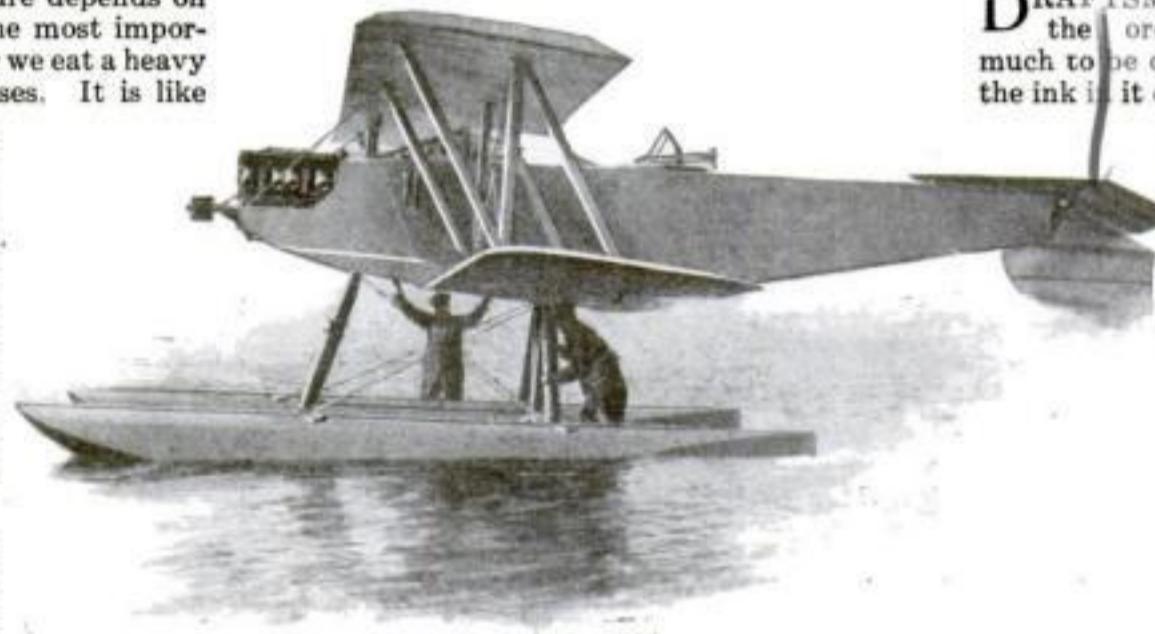
"The evidence is conclusive," said he, "that the tropical sun has the power to store up more energy in the form of cellulose in a given time than has the temperate sun. If this is in a utilizable form, it remains for the ingenuity of man to overcome the difficulties of profitably applying it. With the increasing needs of the nation it is reasonable to expect that sooner or later it will be necessary to utilize more fully the plant resources of the tropics."

**Press the Knob and Fill the Pen**

DRAGTSMEN and artists say that the ordinary ruling-pen leaves much to be desired. It blots easily and the ink in it does not last long. Besides, if not used up quickly, it dries up.

The pen shown above is so constructed that the ink does not dry up.

This result is accomplished by preventing exposure to the air. A small handle at the top of the pen allows the ink to be drawn up when it is pressed. This is a siphon arrangement that supplies the pen with enough ink for several large drawings. A compass-leg may be attached to the device if desired.

**Two Wings Fly as One on This New Seaplane**

IN the new seaplane built for the government the remarkable feature is the "stagger," or backward position, of the lower plane. In many biplanes the wings are nearly in an exact line of the vertical plane, passing across their front edge.

The stagger reduces the head resistance as the machine passes through the air, permitting a speed of 110 miles an hour; a low landing speed of 52 miles an hour is also possible.

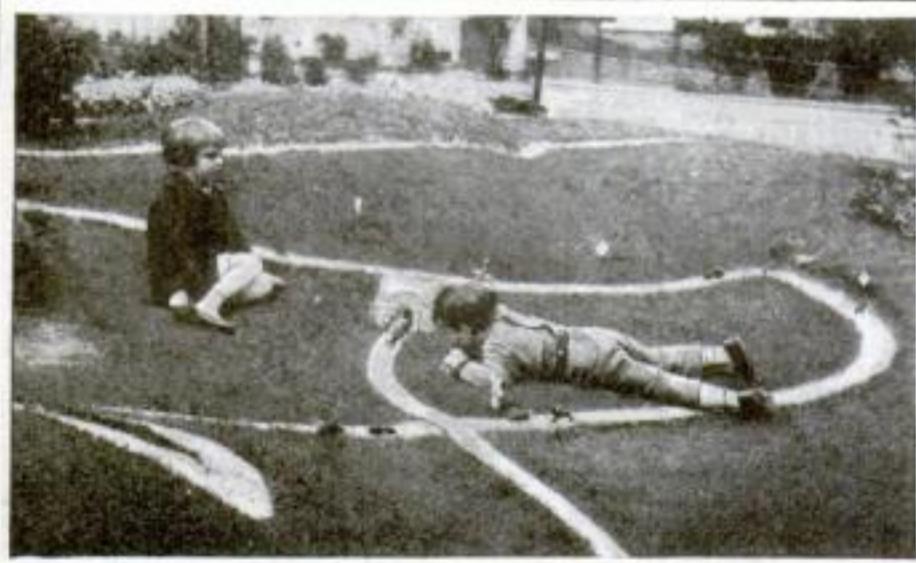
The general effect of the stagger is to give the biplane a performance almost equal to that of a monoplane. This new flying-boat is slightly longer than thirty feet and has a span of 450 inches. It can carry 942 pounds and weighs 2290 pounds. It is what is known as a tractor seaplane mounted on two floats.

Doors that Slide Out of Sight

CLOSET doors invariably open out. Now, however, a new kind of door, a "vanishing door," has been invented. It is hung on two pivoting arms at top and bottom and it swings in, or rather slides in, toward the side of the closet when opened. The door fits snugly against the side wall and is never in the way.

The picture below shows a schoolroom clothes-closet equipped with vanishing doors. Even a small child can open them easily and without making any noise.

Wherever the necessity for conserving space is important, these vanishing doors will be a boon, as, for instance, in a small city flat, where they allow more closet space.



Real concrete forms the foundation of this toy road



These doors vanish into the sides of the closet



Stretch Leather with Hot Water

PEOPLE troubled with corns always dread new shoes, since they are productive of a great deal of pain during the breaking-in process.

Few people understand the physical properties of leather and therefore they do not know just what to do as a remedy, and yet it is very simple. An expert in leather simply advises the use of hot water.

A soft rag is moistened with hot water and held over the area of the shoe that hurts the corn. The leather will absorb a certain amount of the water and this will cause it to stretch.

An application of this nature will offer permanent relief to any one suffering from a tight shoe that is pinching a particularly sensitive corn.

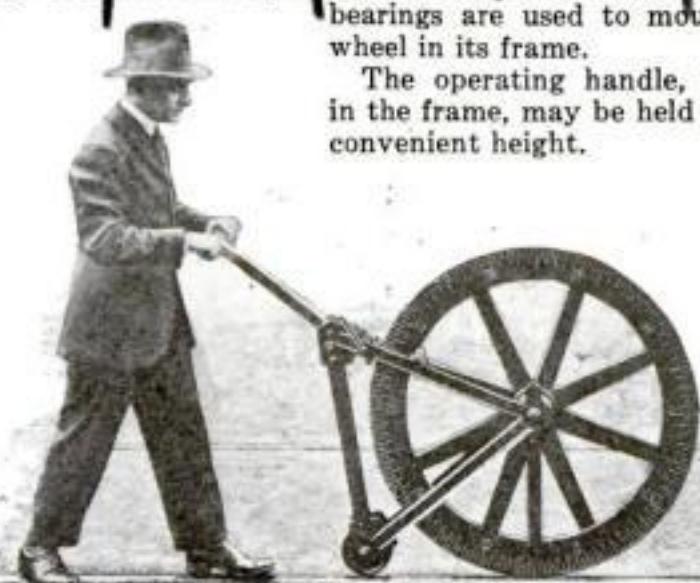
Of course this treatment can be applied to any leather in need of stretching.

The Trackometer and How It Works

IN order to eliminate the use of a steel tape for track measurement, a trackometer has been perfected. One man operates the instrument while another man makes and records the readings.

It consists of a ten-foot measuring-wheel with an adjustable brass tire having a calibrated circumference, graduated in feet, tenths, and half tenths, and numbered every foot. A strip of rubber inserted between the tire and the wheel furnishes the necessary resilience in adjusting the circumference, and roller bearings are used to mount the wheel in its frame.

The operating handle, hinged in the frame, may be held at any convenient height.



The hand-brake will lock this trackometer in any desired position

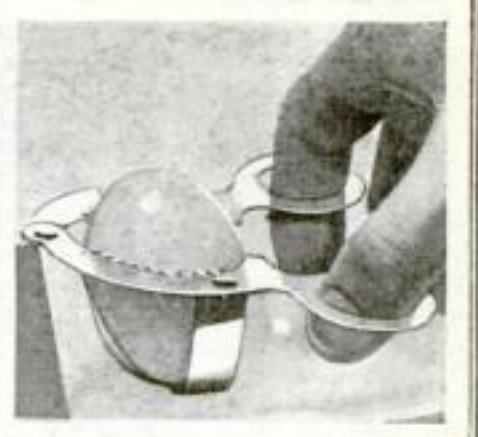


Mother Eagle Endangers a Camera Man's Life

SUPREME in the bird world is the eagle and he will not allow any bird, or in fact any curious human being, to pry into his private life.

A moving-picture photographer decided to photograph an eagle's nest without going through the form of consulting the mother bird.

He climbed a near-by tree, got his camera in position—and suddenly there was a dreadful commotion. The mother bird had spied him! Indifferent to his larger size, she flew at him and made him so uncomfortable that he climbed down the tree as fast as he could. The picture shows the eagle in the interesting position of "backing water" as she starts her attack.



It's a Mechanical Egg-Cracker

FEW people can crack an egg with any amount of skill. Yet in the case of both a raw egg and a boiled egg this is an important matter.

There is now on the market an egg-opener that will do the job for you. It consists of two curved blades with jagged edges that are joined together at one end and have scissors-like handles at the other. Metal strips for holding the egg in position are fastened to the blades.

When you wish to crack the egg, you press the handles together and the jagged edges of the blades will make a clean cut. If the egg is a raw one, you can be sure that the yolk will not be injured by the blow; hence you will be able to "separate" the egg.

ALL artists' studios have a north light because it is free from direct sunlight, varies less, and contains more blue than average daylight.

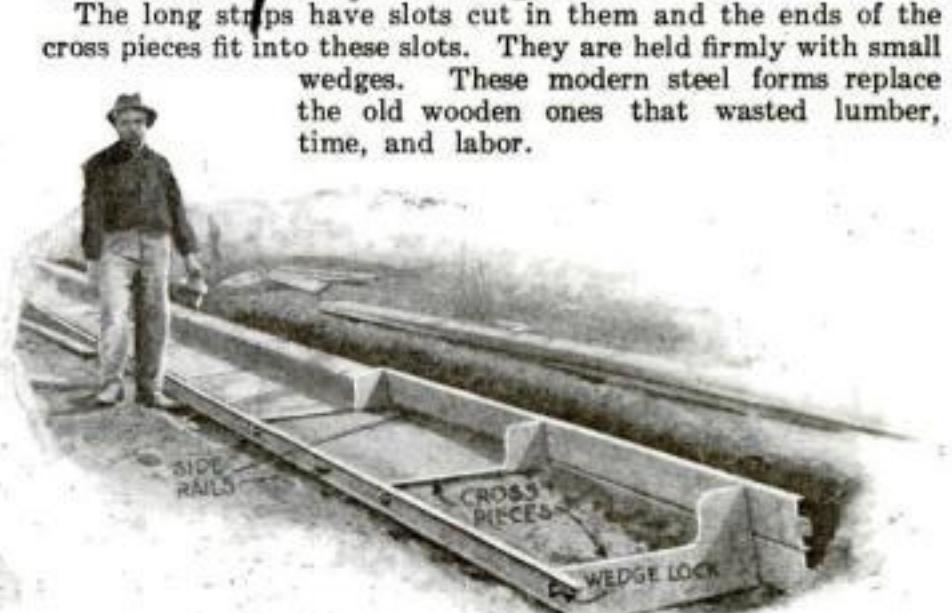
Casting Concrete Curbs in Molds

THE science of laying concrete has made great strides in the past ten years. Buildings are nowadays literally poured into shape.

The steel form here shown will enable workmen to deduct many hours of labor from their work of putting down concrete curbs.

These steel forms are collapsible and they may be packed into a very small space after they have been used. The joints of the various pieces are made to interlock.

The long strips have slots cut in them and the ends of the cross pieces fit into these slots. They are held firmly with small wedges. These modern steel forms replace the old wooden ones that wasted lumber, time, and labor.



Showing the steel mold and the concrete curb



Electric Shocks Stimulate the Hen to Lay

ACTUAL physiological effects produced by mild electric shocks are still a mystery. Professor Bernard, an English experimentalist, has succeeded in making his hens lay more eggs by giving them mild electric shocks.

He has constructed his roosts in such a manner that the hens will receive a shock when they stand upon them. A very small amount of current passes through their bodies and they are unaware that they are under treatment.

The boxes they lay their eggs in are also arranged to shock them. Means are provided to regulate carefully the amount of current, and it is always kept below a value where it would cause any violent nerve reaction.

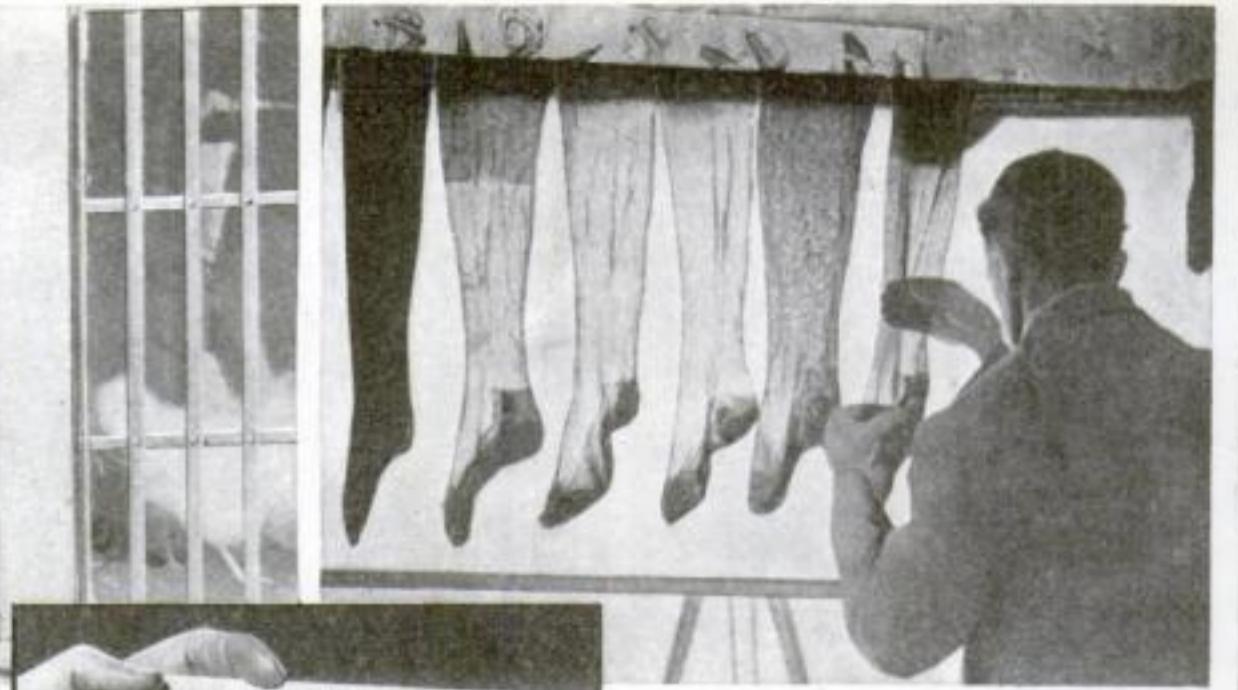
Inner Tubes in Seats

THE idea of the inner tube has been so successful in its application to tires that it is now being tried on seats where the occupant is subject to a great deal of jolting.

In the picture below you see one of these new seats, meant for the use of engineers, truck- and tractor-drivers.

Beneath the usual cushion there is a metal air box that has a cover of rubberized cloth. Inside the box the inner tube is lodged; it is filled with air.

Most of the vibrations of the road are absorbed by the inner tube arrangement, and the driver or engineer, as the case may be, is spared many a jolt.



Stockings Can Be Tested with Transmitted Light

MANY things are tested by transmitted light. By "transmitted light" we mean light that is allowed to pass through a substance. Under ordinary circumstances we cannot see through a piece of paper, but when we hold the paper up to a powerful source of light we may see through it.

This simple principle has been brought into use in the examination of silk stockings. The smallest imperfection in a silk stocking will cause the threads to "pull" and in a short time the stocking is useless.

An English manufacturer places stockings before a powerful source of light. The photograph shows how easy it is to see through the stockings when they are hung in this manner. This system speeds up inspection work.

Machine Pulley Calculation Is Simplified

FOR determining the size of pulleys required on a machine belted to a gas-engine this simple calculator has been invented. It has a dark disk which is movable and which has graduations to represent pulley diameters in inches. The outer circle has its graduations in revolutions per minute of the engine.

The dark disk is set with the engine-pulley diameter in inches to the known revolutions per minute of the engine. The diameter of the pulley required will be in line with the revolutions per minute.

It Has Only Two Legs

NATURE forgot to give this calf enough legs, so the farmer who owns it had to devise means to help it. He built this little stand for it so that it may eat and drink comfortably. When not resting on this stand, it is necessary for the animal to spread itself on the ground. This animal is of interest to scientists. It has been found that leglessness is inheritable.

Something New in Mops

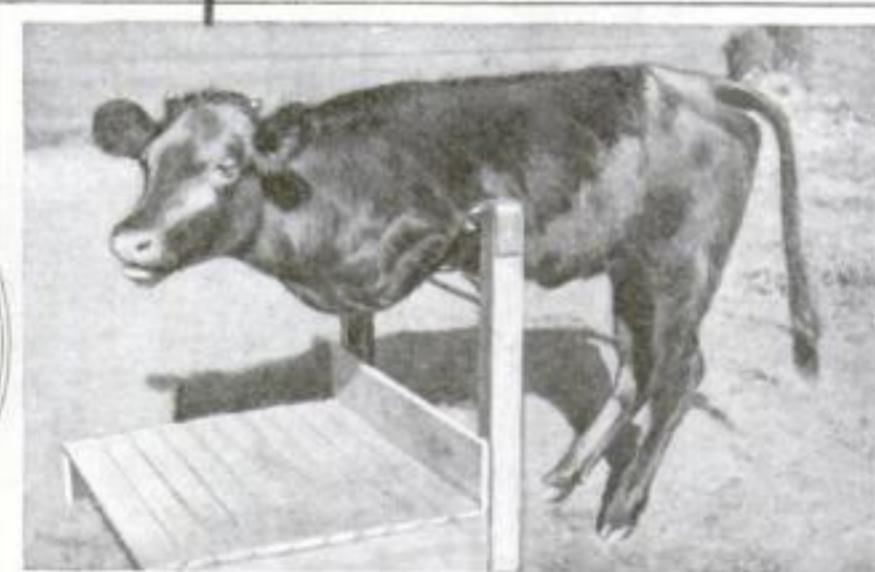
LIKE everything else, mops can always be improved on; here you see a new mop that is different from the mops to which we are accustomed because it has been improved.

In the first place, this new mop wrings itself. The rope section is not attached directly to the wooden handle, but passes beneath a roller at the end of the handle. When you have finished mopping a floor, you take hold of the wire at the top of the mop and pull the mop through. Then you hang it out to dry.

Later, if you wish, you can use the mop as a duster for the polished floors.



A shock-absorbing seat



How the deformed calf holds himself up



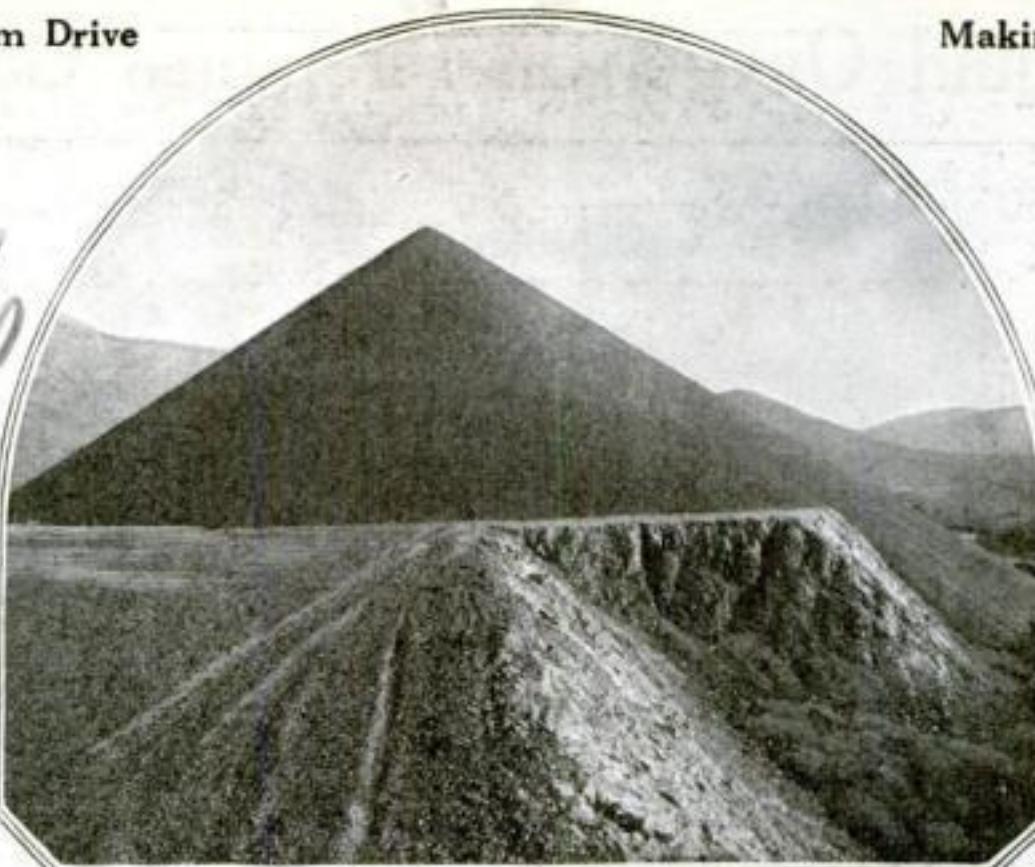
This mop wrings itself

Leather Cups Help Him Drive

WITH his arms severed above the elbows in a railroad accident, this man turned inventor because he wanted to drive his car. To overcome his tremendous handicap he added a number of leather cups to the driving-wheel of his light car.

The cups have metal bottoms that grip the wheel tightly. Five of them are arranged around the wheel and these enable the armless driver to turn quickly in practically any direction.

The driver has gained considerable experience in handling his little car and he is able to thread in and out of the traffic in Kansas City with perfect ease.

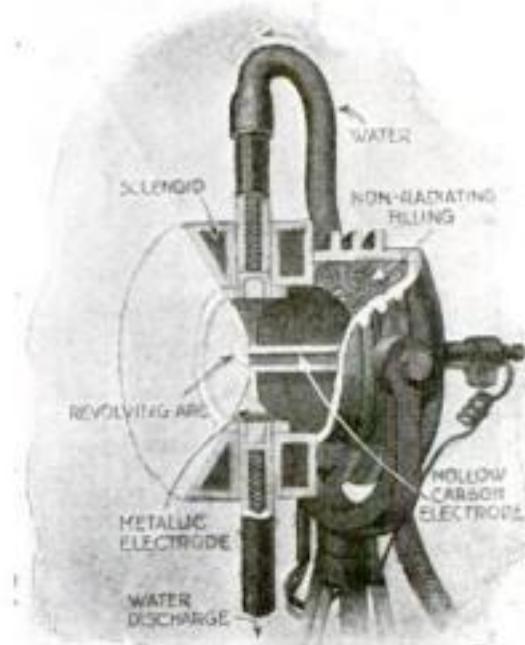


Armlessness did not daunt this driver.

Spinning Arc Makes the Light

IN the new arc light that a French inventor has brought out only one carbon electrode is used. The free end of the electrode passes through the center of a metal disk and this is the second electrode. The arc is established between the edge of the hole in the disk and the end of the carbon.

Both electrodes are kept cool by circulating water. A large coil of wire is placed around the metal electrode. When the current passes through the coil it sets up a magnetic field about the arc, causing the arc to rotate around the circle at three thousand revolutions a minute.



How the arc is established with one carbon electrode

This Perfect Cone Is a Waste-Pile

IT took twenty years to pile up this huge cone of waste material. It contains millions of pounds of slag from a smelter near by. The waste slag was dumped from a central point, and as time went on a perfect cone started to form. This soon reached a height of three hundred feet and from a distance it resembled a great pyramid.

The outline of the cone slopes in a straight line at an angle of thirty degrees. The slag was lifted to the top of the pile by a bucket conveyor.

Engine Gives Speed to Bicycle

THIS little motor develops a full horsepower, although it has only one cylinder. It is air-cooled, and the parts are made of an aluminum alloy, so that the machine is very light.

The engine may be quickly attached to any bicycle with a wrench and screwdriver. One hundred and fifty miles may be covered on one gallon of gasoline. The cylinder is lubricated by introducing oil with the gasoline.



Attach this motor and save fatigue

Making a Bicycle Seaworthy

STARTING with an ordinary bicycle, a Belgian inventor named Goffin built a boat. In place of the rear wheel he installed a propeller, which he operated by means of the regular bicycle pedals. Around the bicycle he built a boat-shaped body that he mounted on air-filled pontoons. He attached a rudder to the rear end of the body. It was then ready to go. The picture below shows how this novel machine looked in the water.

Taking his place on the saddle, Mr. Goffin started the pedals and his boat traveled forward. It was such a success that many Belgian sportsmen are now demanding duplicates.

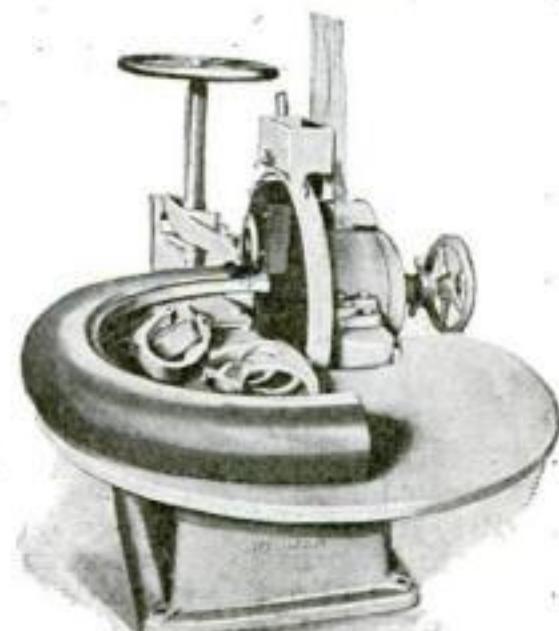


M. Goffin's much disguised bicycle

Knife for Cutting Tire Sections

A SHARP circular knife cuts through a tire section with ease. The knife is power driven and water is allowed to drip on the point of contact from a tank above. Rubber should always be cut with a wet knife.

The tire is placed over a mandrel, which holds it while the knife cuts. The section-cutter is used in the laboratories of tire manufacturers. Chemists and physicists make use of the sections where possible instead of using a whole tire. Sections, such as are used in salesrooms, also serve to show the complete tire construction.

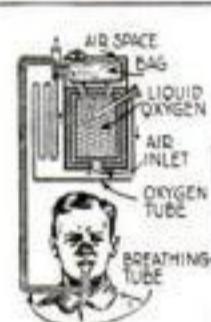


This is a tire-slicer

Using Liquid Oxygen in Firemen's Gas-Masks



This mask contains a two-hour supply of liquid oxygen. Usually compressed oxygen is used in gas-masks. Dr. Bernhard Draeger of Lubeck, who invented this mask, has devised a method for converting the cold liquid oxygen into warm vapor before it is breathed.



Liquid oxygen is poured into a large flat tank through which a flow of air is constantly passing. The air causes the liquid oxygen to evaporate, after which it passes through a long coiled tube in which it is warmed. Exhaled air goes into a rubber bag that expands and forces the evaporated oxygen down the tube.



The fireman wears the tank on his back; as you see, the coiled tube through which the oxygen passes is exposed to the air, which warms it. The man inhales seventeen quarts of vaporized oxygen a minute, and the gas he exhales escapes through a convenient valve.

Air Takes the Place of Eight Carpenters

THE air-driven planer here shown is equipped with a revolving knife that is connected directly with the shaft of a small but powerful air turbine. When the air is allowed to pass through the device and it is brought in contact with wood, chips fly in every direction.

This is indeed a very busy little tool. Its manufacturer claims it will do eight men's work.

During the war this air-driven plane played a part in the construction of wooden ships. In a contest the machine planed off a big timber twelve by sixty inches in fifteen and one half minutes. It took nine men twenty-two and one half minutes to do the same job.



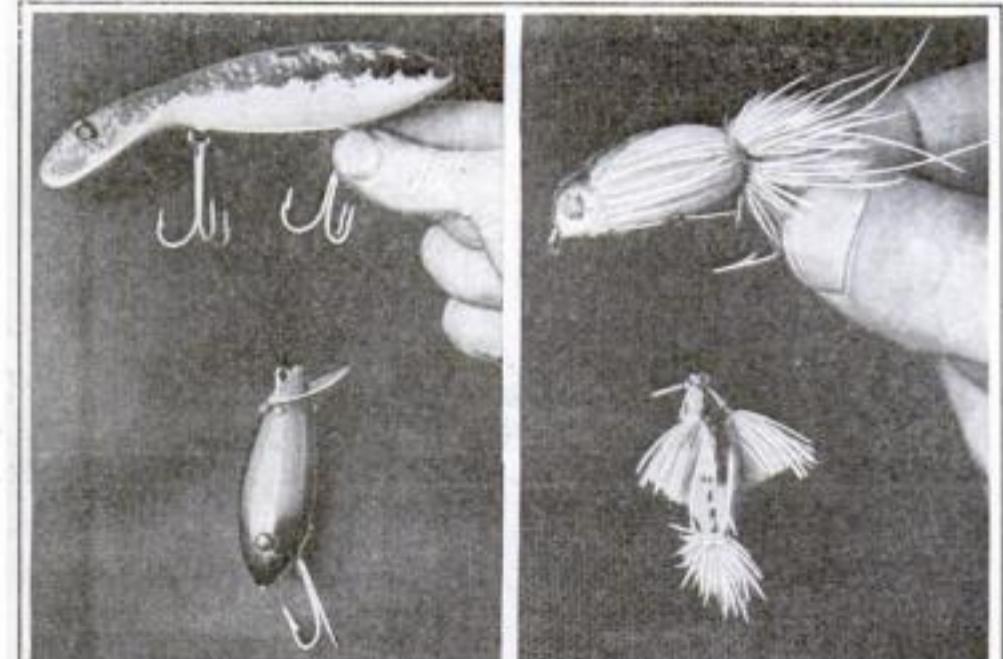
This air-driven planer, which actually does the work of eight men, was particularly useful in building wooden ships in the war.

Time Off for the Airplane Pilot

AN automatic stabilizer that will keep an airplane steady in flight without attention from the pilot, has been invented by Georges Aveline, a French engineer.

Briefly, the device consists of a circular tubular container half filled with mercury, which makes an electrical contact when the plane tilts, actuating a compressed-air cylinder, which gives the proper movement to the control devices.

Planes have been flown for two hours without a hand on the controls, and the device has been adopted by the British Government. The aviator can instantly disconnect the device and take charge of the machine himself if it should become necessary.



The wooden creature on the left wiggles through the water like a minnow; that at the right is made of deer hair.

New Flies for Anglers

MANY anglers are now using a plug of wood painted and shaped to the general appearance of the live creatures they formerly depended upon. Some of the "plugs" are so made that a tiny propeller revolves close to the head, producing swirls such as those of a darting minnow. Others wobble and wiggle, the action resulting from finishing off the head end at an angle or attaching a small metal collar. As the bait is drawn through the water, it dives or wobbles.

Another form of lure is made of deer hair built into the form of an insect or small animal.

Make the Phonograph Record Loud or Soft

This clever invention can be used in either a room or an auditorium

WHY is it that, after you have spent several dollars on a wonderful piano solo played by Hoffman or Paderewski, you are disappointed when you put it on your phonograph? And how inadequate are the phonographic strains of a band concert!

A well known English manufacturer undertook to improve this condition, and has now perfected a sound-control phonograph that he calls the stentorphone.

How the Sound Is Regulated

This amplifier, which possesses no electric amplifiers to get out of order, is capable of magnifying ordinary phonograph sounds ten times. A lever, however, regulates the sound to accommodate the acoustics of any interior, from a small room to so large a place

as Carnegie Hall in New York. Its first application was during the war, when it was installed in an airplane so navigators could shout instructions to troops.

The stentorphone is controlled by a small electric or gasoline-driven motor of one-half horsepower that drives an air compressor. The air, under a pressure of ten pounds to a square inch, is delivered into a small cylinder or air reservoir. From the air reservoir the air is conducted through an india-rubber pipe to another cylinder in the phonograph cabinet. Thence it passes through a tube to a regulating cock, where it may be by-passed through a silencer into the atmosphere or directed into the sound-box.

Within the sound-box is a simple grid valve, delicately sprung and balanced. When the by-pass is closed,

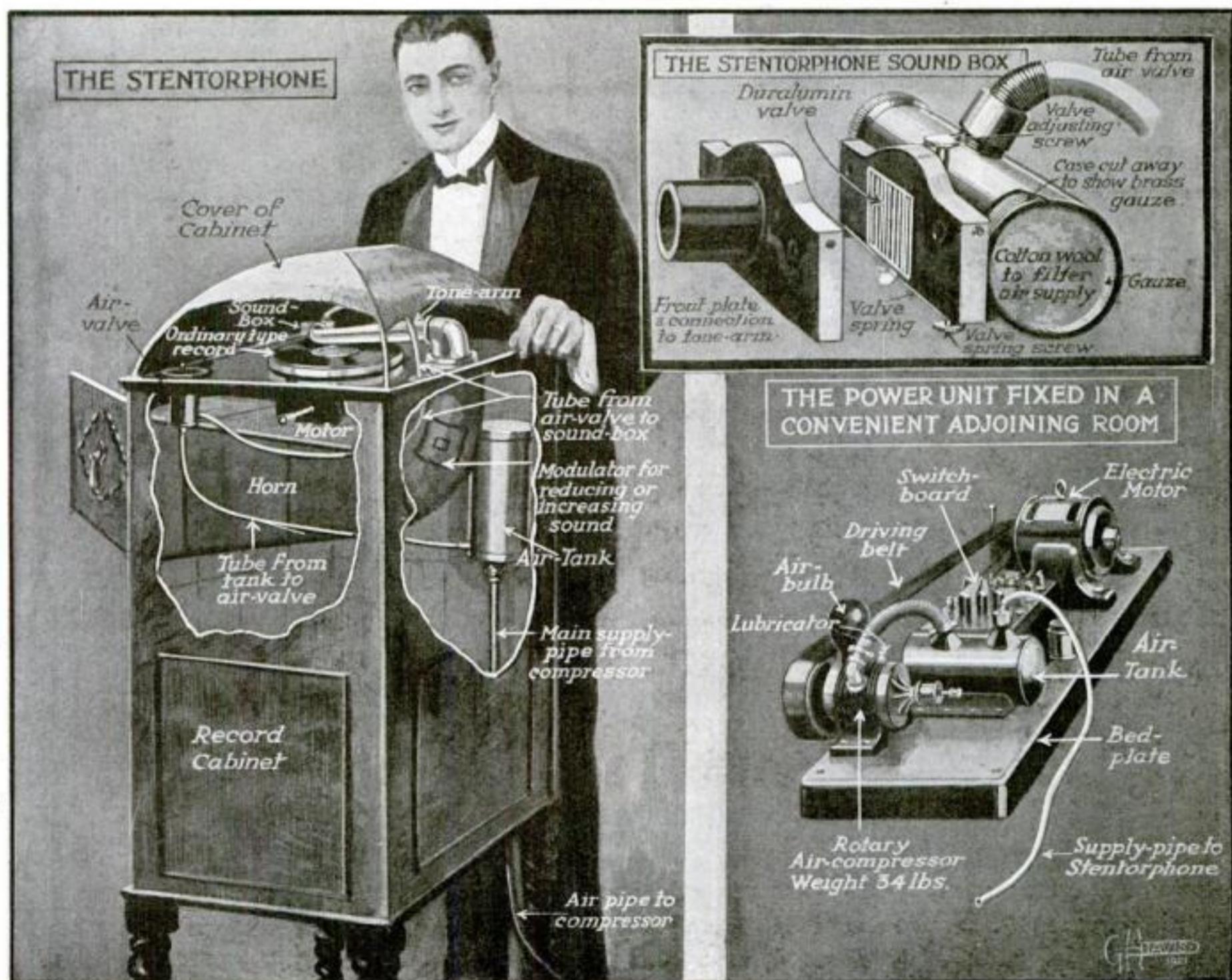
the full volume and pressure of air is exerted against the sound-box valve, which opens to its full extent and virtually serves the same purpose as the blower of an organ, the volume of sound depending upon the amount and pressure of air.

The Simplicity of the Mechanism

The moving portion of the valve is in one piece with the needle-holder.

There are only three parts to the valve. On the sound-box is a screw for regulating the flow of air to the sound-box valve, a rising and falling rod, marked for position, indicating when the adjustment is correct. In full blast about six cubic feet of free air a minute is delivered to the sound-box.

The disk table may be independently operated by a clockwork motor or by a tiny compressed-air motor.



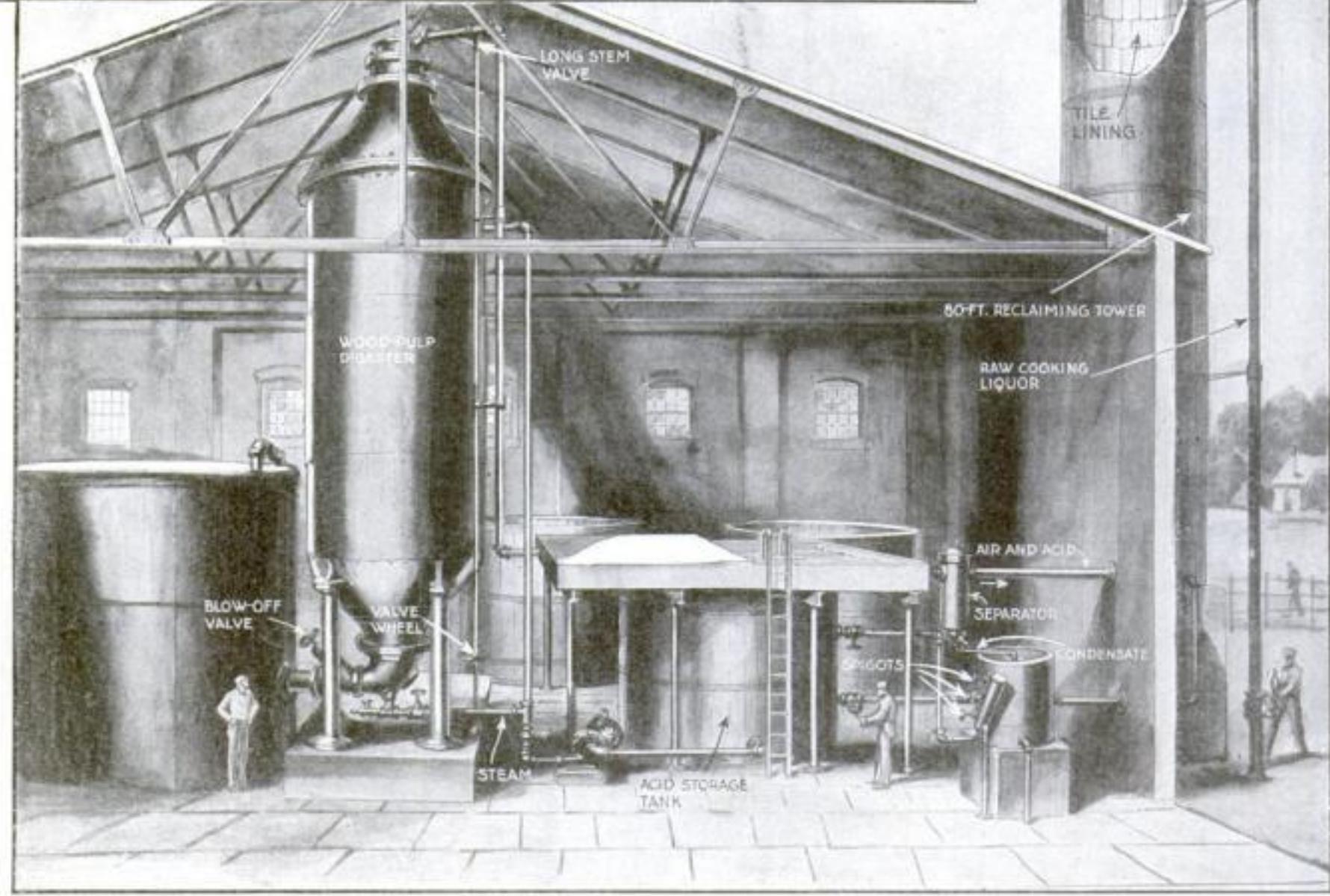
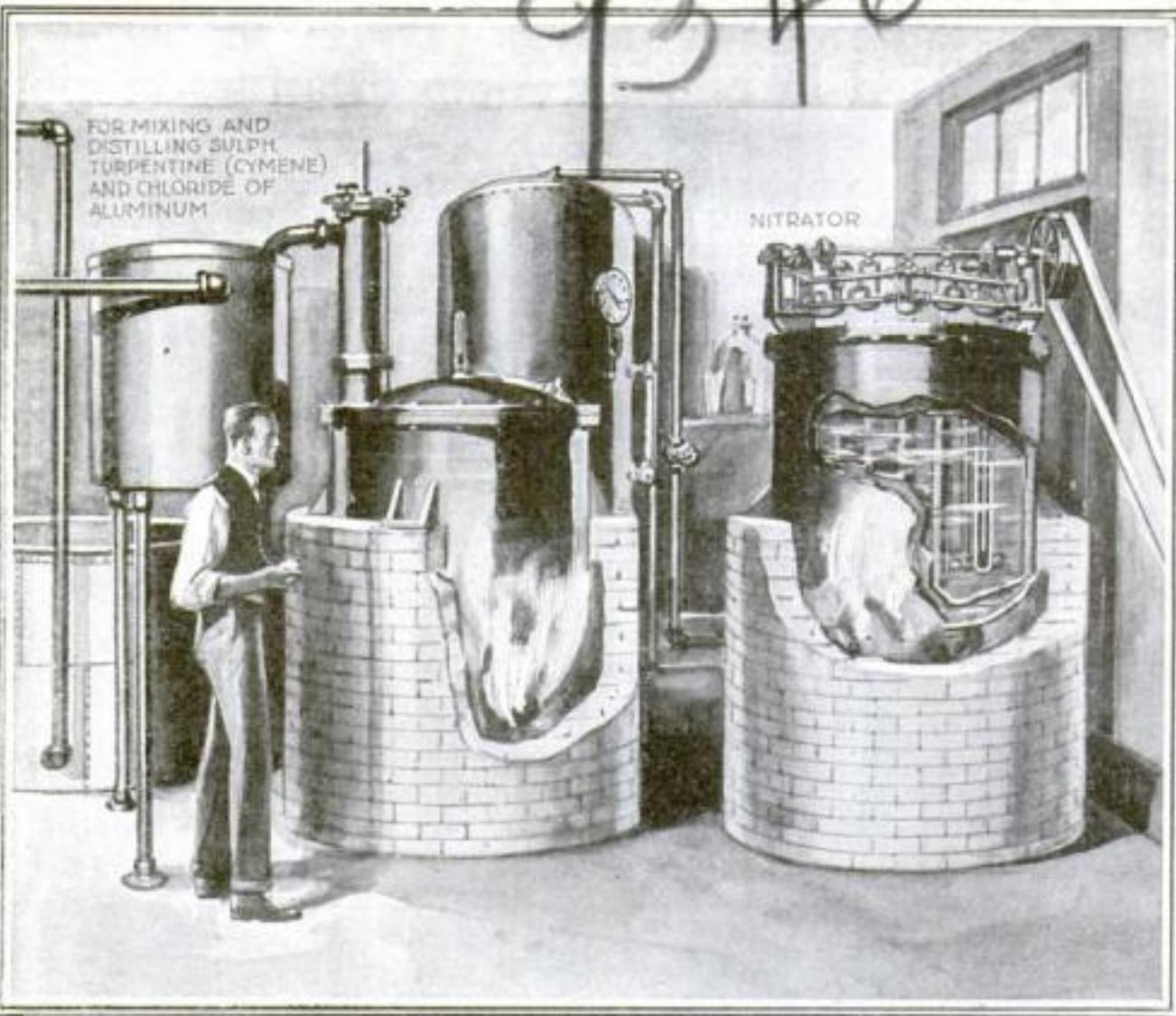
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Driven by a small electric motor that may be placed in another room, air is forced into a cylinder, thence through a rubber tube into another cylinder in the phonograph cabinet, to a regulating cock, and into the sound-box,

where a pressure of air is exerted against a grid valve in much the manner of the blower of an organ. The valve is so connected with the needle-holder as to amplify the sound.

Drawing by G. H. Davis

9346



Gas Given Off by Wood-Pulp Now Used for TNT

Sulphite turpentine, which is given off when wood is boiled in the making of paper pulp, has been put to use. From it cymene is extracted, and cymene is one of the principal ingredients of trinitrotoluol—known as TNT.

The steam and gases created in the wood-pulp digester pass through a tube into a long coiled pipe that rests in

a shallow wooden pan filled with cold water. Here the temperature of the steam is reduced and emerges from the pipe in liquid form. It passes into a separator, where the cymene rises to the top and is drawn off through spigots.

This crude cymene is then purified in tanks like those shown in the upper left-hand corner of the page

Getting High Explosives from Our Forests

A tree may furnish the TNT that will later uproot its stump

CRASH! A giant spruce-tree falls to the ground, leaving behind it a deep-rooted stump. Parted forever? Not necessarily; it is quite possible that the tree may come back in another form and blow up the very stump that supported it all its life. For cymene, an oil necessary in the manufacture of the explosive known as TNT, is now produced from the pulp of spruce, fir, and balsam trees. And since the war TNT has been used extensively for land-clearing, road-building, and similar blasting operations.

Sulphite turpentine, from which cymene is derived, has always been the bane of paper manufacturers, and it was primarily through the efforts of a paper-making company that this turpentine was put to use.

First the Wood-Chips Are Cooked

In the manufacture of paper, the logs are chopped into chips, which are put into an enormous steel digesting-tank.

This tank is filled with water in which bisulphite of lime has been dissolved. Then the mixture is boiled under pressure and at high heat. This boiling takes the tars, resins, and color out of the wood fiber. The cymene escapes in the steam and gas. By the new process, this is now distilled.

The gases are driven into a coiled lead pipe several hundred feet long which rests in a wooden pan filled with cold water. The pipe is cooled by the water passing over it, just as is the worm of a still. The temperature of the gases passing through the pipe is reduced below the condensing point of steam. Therefore from the end of the coil there emerges a liquid and the remaining vapors; they pass into a separator.

The separator consists of an antimonial lead pipe five feet long and twelve inches in diameter. In the center of the pipe is a lead partition or a baffle-plate. It extends to within a foot of the bottom of the pipe. The liquid and the gas strike the partition. The liquid, which consists of sulphite turpentine and sulphur-impregnated water, drops into a separating-tank. After it has stood in this container for half an hour, the two constituents

Two tons of wood-pulp will produce one gallon of cymene, from which six pounds of TNT can be obtained. Everybody knows that this high explosive is so powerful that six pounds is a very large amount indeed.

What are the peace-time uses of TNT? Among other things, it is growing in popularity with the managers of big Western farms because of its usefulness in clearing land, splitting logs, making ditches, etc. Of course the storing of such powerful stuff is a very important matter, and should be made the subject of legislation.

separate. Cymene, being lighter, rises to the top, and may be drawn off by spigots placed at various levels. A funneled pipe receives the cymene and carries it to a storage-tank. Here again there are spigots, so that if any water remains it will be finally removed.

If there still are traces of sulphur dioxide, they may be neutralized by adding lime. Now the crude cymene is ready to be shipped in large metal drums to plants where it will be converted into an explosive.

Let us hark back for a moment to the vapors that we left striking against the baffle-plate of the separator. They go under the leaden partition and are forced into a wooden tank about eighty feet in height called a "reclaiming tower." The inside of this structure is filled with hollow acid-resisting tiles in order to increase the absorbing surface. Into the top of the tower a raw cooking liquor for use in the digester tanks is pumped; it trickles down through the tiles, absorbing the gas, and finally leaves the tower from the bottom through a pipe that conveys it to a tank where it is stored until needed. The vapor thus saved represents real money. Instead of being permitted to escape into the air it has enriched the liquor which is to be used in cooking fresh wood.

The Chemical Parson Gets Busy

The method of conversion considered most effective was invented by Professor Ralph H. McKee, of Columbia University, formerly the official chemist of the Paper and Pulp Association.

Nearly all the sulphite turpentine as it comes from the pulp-mills, consists of the hydrocarbon cymene. This

crude cymene is first passed through a mass of calcium chloride, which is the ordinary bleaching-powder used in laundries. It has a great affinity for water and dries out most of the remaining sulphur solution. The sulphite turpentine is again distilled. It is mixed with about 5 per cent of its bulk of chloride of aluminum while a stream of hydrochloric-acid gas is passed through it. Here we are in the presence of one of the mysteries of science. The chloride of aluminum is a "chemical parson."

Although no trace of it appears in any of the resulting products, it brings about certain new unions of atoms that have undergone molecular divorce. Pure cymene, or toluol, as it is often called, has now been obtained.

The changing of this forest toluol into an explosive is simple. It is combined with sulphuric and nitric acids until it is triply nitrated—whereupon it becomes trinitrotoluol, which is the proper name for TNT.

W. A. Schorger, of the United States Forest Service, places the average amount of cymene derivable from a ton of pulp at half a gallon. The present annual output of pulp in the United States and Canada is more than two million tons. Thus a million gallons of cymene could be obtained in America each year. And from a gallon of cymene six pounds of TNT can be made.

TNT's Peace-Time Uses

What are the peace-time uses of TNT?

As has been mentioned before, it is used in various blasting operations. Take, for example, stump-blasting. One report shows that a solid oak stump three feet in diameter, rooted in clay, was split into three large pieces and thrown ten feet into the air by a small charge of TNT.

Again we find that splitting logs, making ditches, and breaking boulders are three more of its accomplishments.

Used for land-clearing in general it is very successful. Tests were made on two thousand farms in Wisconsin, and as a result all the farmers in the vicinity are anxious to buy TNT. Its new source has apparently been discovered at just the right time.

15649 + 18364

Popular Science Monthly

Tricks on the Phonograph

Bent pins, paper funnel, or felt hat will draw music from it

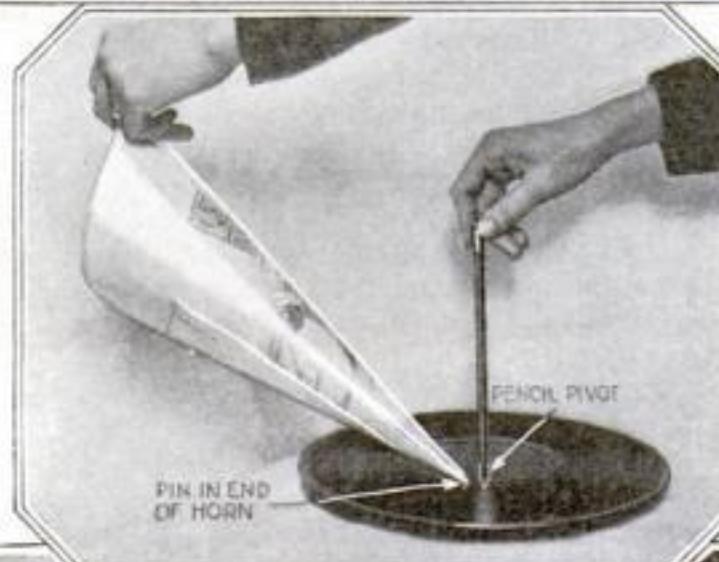
Holding a fiber needle between his teeth, the young man at the right plays a record with it. He has stopped up his ears and yet he hears the record plainly — through his head. It is possible that deaf people would be able to hear music in this fashion.



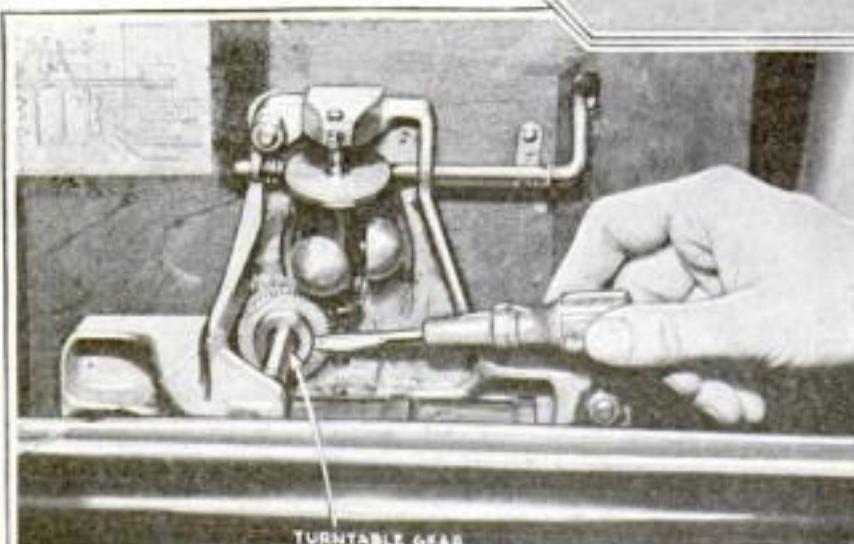
"Alice in Wonderland" is the name of this record with the extra hole punched as shown, and, your phonograph will put it through as many weird tricks as Lewis Carroll did the original Alice.



Take two pins, chop off their heads, and insert the blunt ends into the needle-holder. By bending the pins in the manner shown you can play two parts of the record at the same time — after the fashion of "Three Blind Mice."



Be your own phonograph. You can do this by pushing a tightly fitting pencil through the hole in a record and twirling it evenly; in the other hand you hold an improvised horn to which a long pin has been attached. As you twirl the record the pin travels in the groove and the horn gives out the music.



By changing the regular speed of your phonograph you can make sopranos sing bass. How is this done? By loosening the set-screw in the hub of the gear. The speed will drag at first and then it may increase.



Put a needle through the crown of a derby hat and hold it loosely over a record. It will travel in the grooves and turn out music as successfully as if it were screwed into the tone arm. However, you must have a steady hand to do this successfully.

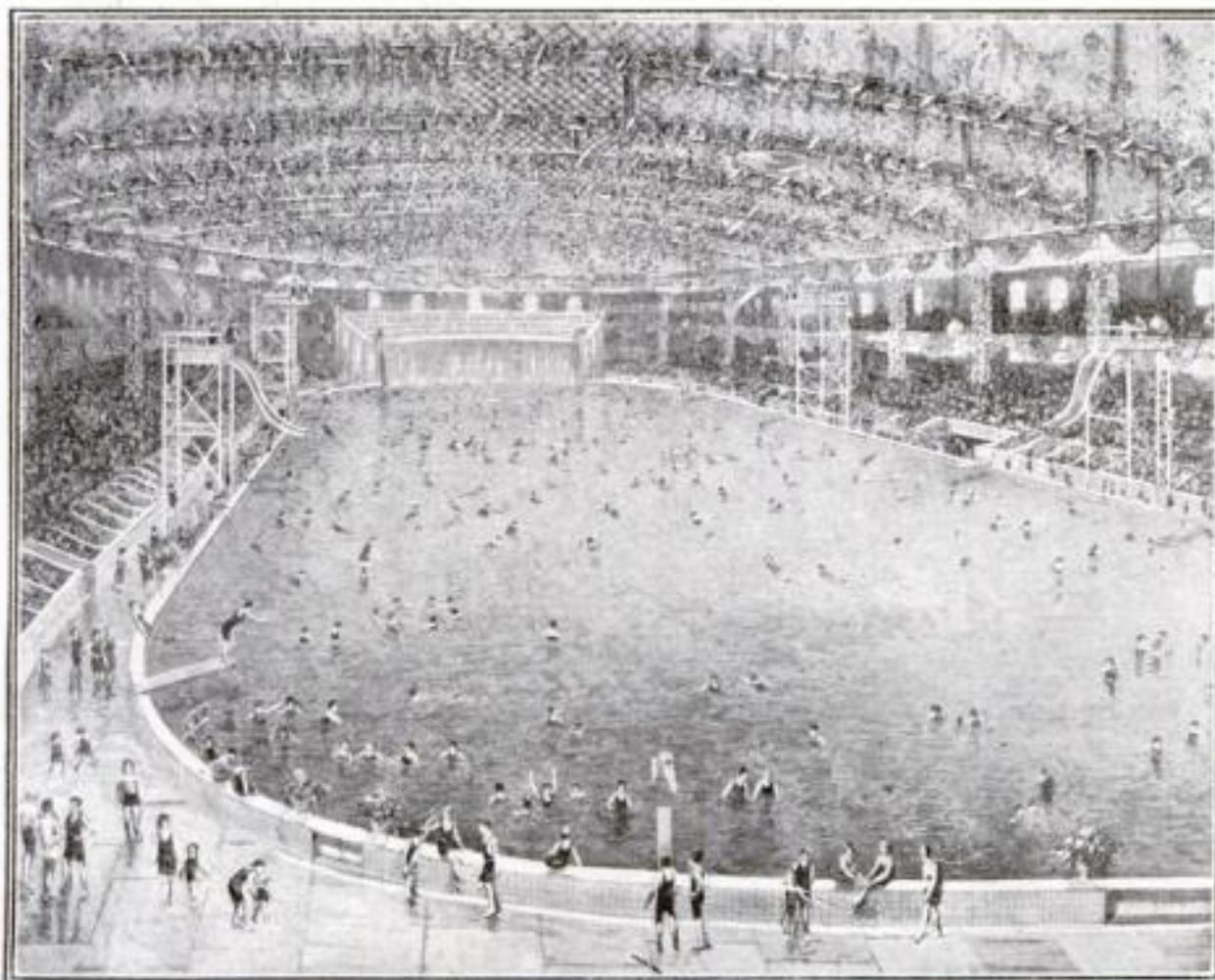
Madison Square Garden Houses Huge Pool

THE interior of Madison Square Garden, in New York city, formerly used for horse, dog, and poultry shows, not to mention the circus, has been turned into one of the largest swimming-pools in the world. This was accomplished at a cost of \$250,000. One hundred men, working for two months in day and night shifts, effected the really wonderful transformation.

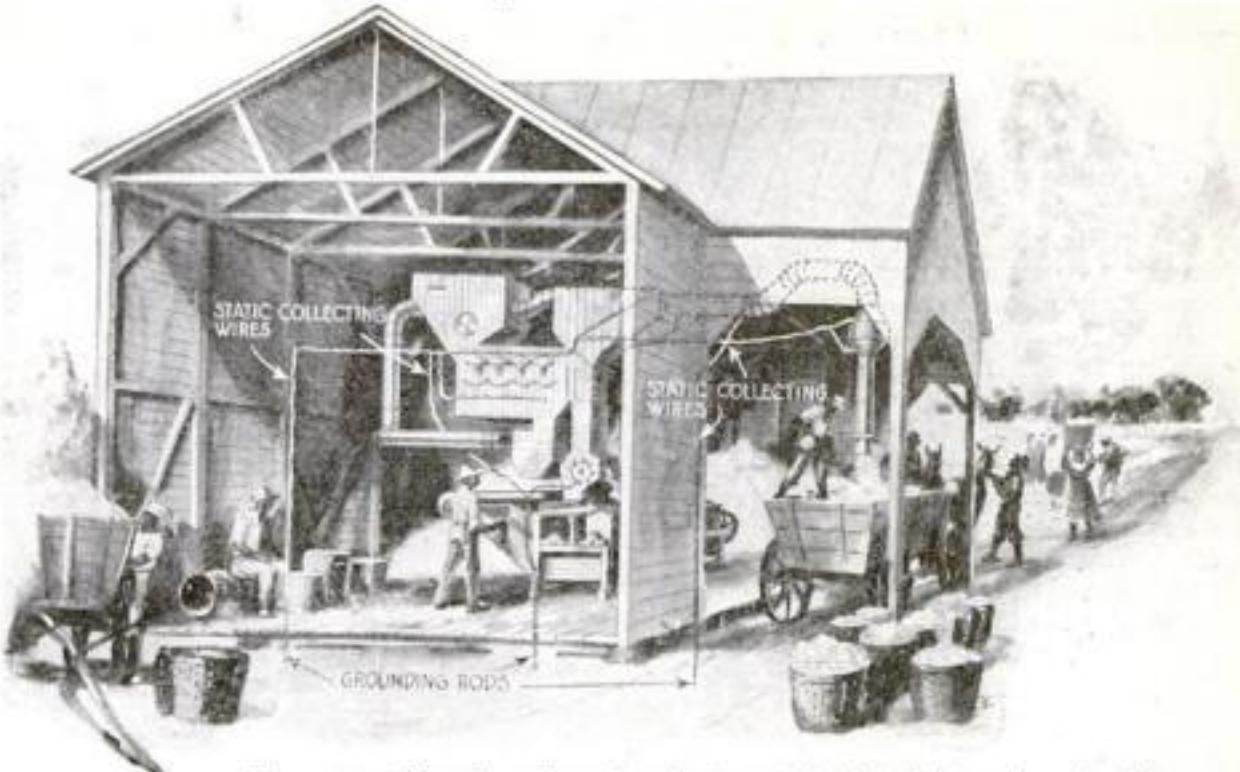
The pool, which is built of marble guaranteed waterproof, is 110 feet wide by 150 long, and holds 1,500,000 gallons of water, kept clean by filtering and sterilizing. It is five and a half feet deep in the center and three and a half feet deep at the ends of the pool. It requires six hours to fill and six hours to empty the basin.

Six diving-boards accommodate ordinary divers, while for the more adventurous there are two fifteen-foot towers, reached by ladders. Lovers of water stunts are looking forward to some interesting "events" in the old Garden this winter—for it is planned to make the pool a permanent institution. Seats to accommodate ten thousand onlookers surround three sides of the pool.

Miniature falls at one end of the pool beautify the place. The sight is worth going a long way to see. Think of the convenience to office workers—for it is in the heart of one of New York's business sections—in the neighborhood. In the dog-days many of these workers preferred a cool swim to a warm luncheon.



Turning Madison Square Garden into a swimming-pool may solve the problem of rental which has threatened the huge place with destruction



To prevent fires in cotton-gins due to static electricity, wires should be connected with the machinery and then with grounding-rods

Grounding Static Electricity to Prevent Fires

STATIC electricity, according to government experts, is responsible for many of the cotton-gin fires that were formerly attributed to matches. Hence it has been suggested that cotton-gin machinery be wired in the manner shown above, so that any static electricity caused by friction will be safely grounded.

Starting at the suction pipe through which all the cotton is carried to the gin, insulated copper wire is connected with the telescoping section directly below the canvas joint. Two or three connections are made along the pipe, depending on its length. All these wires are connected with a heavier

wire, which is grounded. Next comes the cleaner. Contacts are made with all the screens—the larger ones having two wires. All the journal-boxes on one side of the cleaner are also wired. Here a second grounding-rod is installed.

Then all the journal-boxes on one side of each feeder and gin-stand are wired. The screens of the cleaner feeders and the lint-flue are connected and a third grounding-rod is installed. All the various wires should be soldered to the grounding-rods, and the contacts should be very tight.

Static electricity has been the cause of many mysterious fires in the past. It is created by friction between two dissimilar bodies—as, for example, a belt and a pulley. The electricity is stored up, and when it becomes intense a spark will fly between parts of the machinery. In dry weather, when the humidity is low, very little electricity will escape in the air; hence there are more sparks than in wet weather, and in consequence more fires. Men working in cotton-gins have often found that when they pass under a belt in dry weather their hair will rise and their skin prickle—all due to static electricity.

Radium in the Gem Industry

INTERESTING experiments have been carried on by the Bureau of Mines, at Reno, Nevada, with reference to the coloring of gems by radium radiation.

A colorless Colorado topaz, after exposure to the penetrating radiation, acquired a yellow tint. When the stone was exposed to light, however, it lost its tint, and further experiments are now being made to render the radium-induced color "fast."

She Is a Sculptor in Soap

A NEW medium in which sculptors can work has been discovered by Miss Anne Hershey, a student at Mount Holyoke College. Miss Hershey works in common white soap.

Miss Hershey's only modeling tool is a nail-file. With the pointed end she does the finer work, while the cutting away of the soap in getting the general outline of the figure is done with the broad, flat end. The soap models have been successfully used in making castings of plaster, the mold leaving them unharmed. Having advanced the art to the point where castings can be made, Miss Hershey now accepts orders.



Miss Hershey with her soap casts

Expanded Lath for Building

HERE is a new kind of building-lath. It is said to be stronger and more durable than the kind in use at present. It is an expanded lath, and the plaster is filled in between the expansions, while the back is covered with a building paper. Special machinery first expands the wood into longitudinal strips that are connected with diagonal ribs. As will be seen, the ribs are not so wide as the strips, so that the plastic covering when applied gets beneath and around these ribs, forming a perfect key, which becomes a part of the structure itself. A careless workman cannot waste plaster with this lath. It is to a large extent sound-proof. It can be used inside or outside.

STATISTICS of New York's subways convey a picture of teeming life that is almost staggering. In the sixteen years of the subways' life, 4,301,000,000 passengers were carried—about three times the total population of the world.

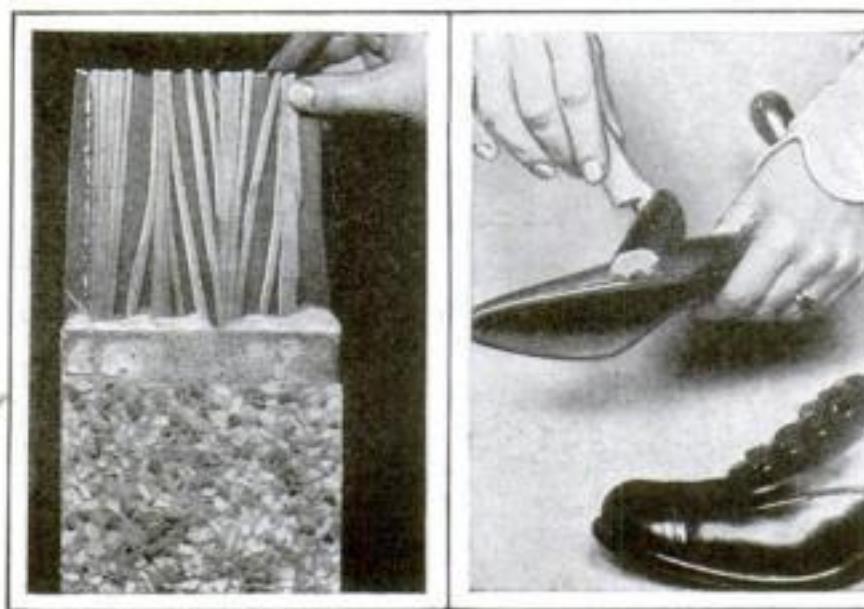


Shop-Window Posters Wear Real Clothes

POSTERS that wear real clothes are the latest startling development in New York's Fifth Avenue shops. These posters are made by Mrs. Cora Scovil, of Pittsburgh, who invented them. She is shown herewith sewing buttons on the knickerbockers of one of her golfing girls.

It takes about a week to dress one of these figures from head to foot. The face is made of flesh-colored sateen and the features are embroidered on it.

The hair is made of corduroy in some instances, and of colored wool in others, when the lady has blonde or gorgeous red tresses, for instance.



Showing the expanded lath

Wax will help shape the shoe

Chest-Protectors in the Subway

THE subway rush in the English metropolis is as intense as the going-to-work-hour rush in the largest cities of the United States.

One woman traveling frequently to and from London was actually afraid that she might be crushed by the crowd in the train some morning; hence she now wears the chest-protector shown in the picture below.

The protector is made of steel and is covered with leather and it serves its purpose very well. Tapes around the waist and around the neck hold this original chest protector in its place.



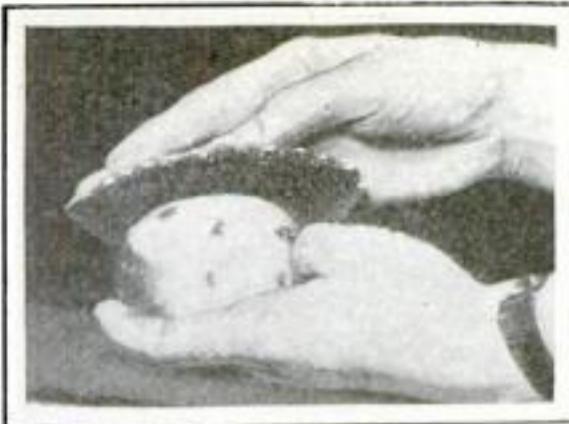
How the protector is worn

Making Shoes to Fit Corns

NO matter how large they may be, new shoes always hurt one's corns. The shoe-stretcher or -last offers little or no relief, since it makes no impression on the shoe where it is most needed—over the corn.

Dropping a little hot paraffin wax or sealing wax over the part of the last where the corn grows on the foot will cause this part of the shoe to stretch and form a depression. A valuable hint to those who are troubled with corns.

THE problem of how tapestry may be woven by machine has at last been solved by a French inventor. Lace-machines and Jacquard looms have brought the cost of these products within the reach of the moderately well-to-do, but tapestry has always been a hand product and too costly for the average home. The machine imitates the movements of the hand weaver exactly, and will weave tapestries up to thirty square yards in size.



Scraping Potatoes Improves Them

MEAT is sweetest near the bone, and the richest nutriment in vegetables is near the skin. Yet we invariably peel the latter and by so doing lose much of their nourishment. In the picture above you see a vegetable scraper that has recently been invented. It enables you to scrape off the skin as rapidly as you could peel it off.

This scraper has a tin top and a handle that you grasp as you would a bath-brush. Its under surface is covered with an abrasive material that chips off the skin as you run it across the surface of the vegetable. Apart from the nutriment gained by preparing vegetables with this scraper, there is an undoubted economy in its use.

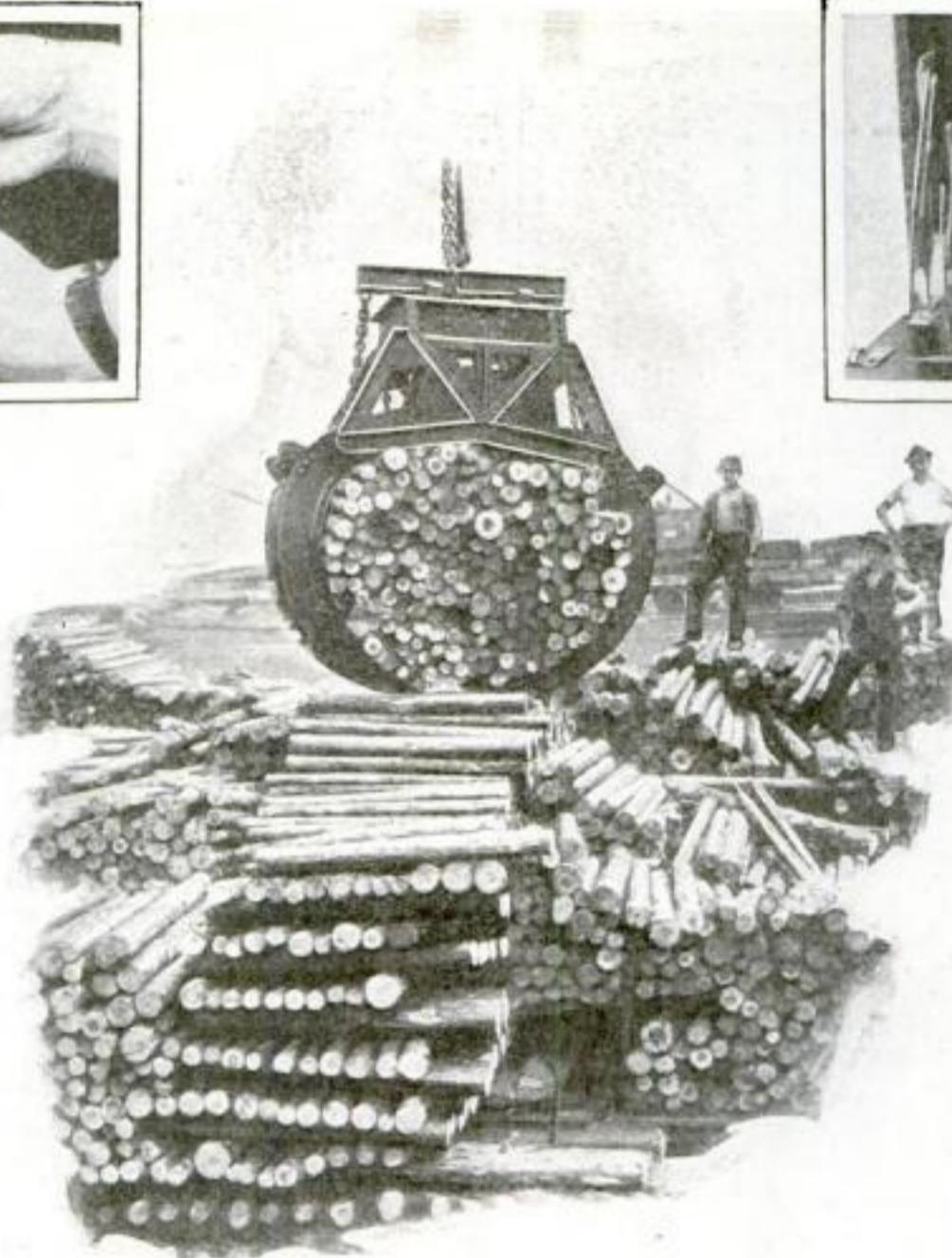
For a Dry Head while Swimming

IT fits well around the neck—at least that much can be said for the swimming “collar” shown below. It is made of celluloid and has a rubber top and bottom. What’s it for? To keep the water out. Why? There are two reasons: one of them is to give the would-be swimmer confidence; the other is to keep her beautiful.

When a wave splashes in the face of a timid girl, she is apt to lose her nerve. The celluloid collar prevents this from happening. However, it also prevents her from putting her head in the proper swimming position; she must hold it stiffly erect regardless of whatever position her body may take.



This gives the would-be swimmer confidence



The Bucket that Grabs Its Load

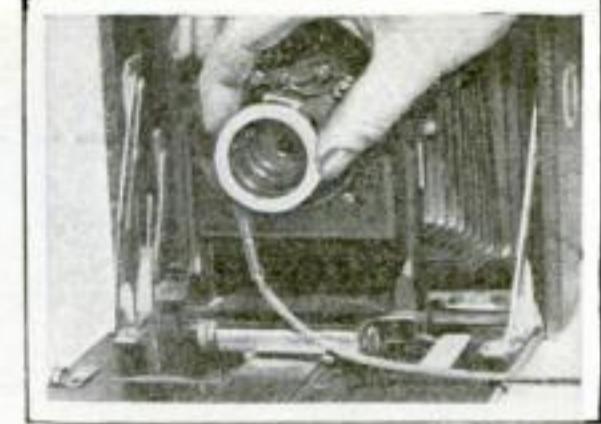
SUPPOSE you have before you on a table a neat stack of matches. To pick up the stack you simply crook your fingers. There you have the principle of the familiar grab-bucket.

It wouldn’t pay to pick up logs one by one with only human arms as tools, particularly in these days of high-labor costs. So the grab-bucket is used, as this picture shows.

The grab-bucket illustrated is practically a fist with two huge fingers. Sometimes the steel fist must close altogether, particularly when coal is hoisted. Then it is called a “clam-shell” bucket. Sometimes more than two members or shells must be provided, and then the fist is called an “orange-peel” bucket.

This particular steel fist is thrust into a pile of logs and picks up about a hundred of them at one powerful grip. One man in a portable engine-house thrusts the open fist into the pile (its own weight is all that is required for that), closes the fist so that it tightly clutches the load of logs, lifts the fist and its load, swings it around and drops it where he pleases—all by moving a lever or two.

It is not difficult to appreciate the amount of labor saved by the use of this huge bucket.



Celluloid Acts Like Half-Tone Screen

THAT round metal ring held in front of the lens of the camera shown above contains a celluloid screen that will soften the outline of objects photographed by the camera. A regular half-tone screen is complicated and expensive for an amateur. This celluloid one contains fine dots that have the same effect as the lines of a half-tone screen. The circular-shaped piece of celluloid is clamped between two glass plates around which is a metal holder.

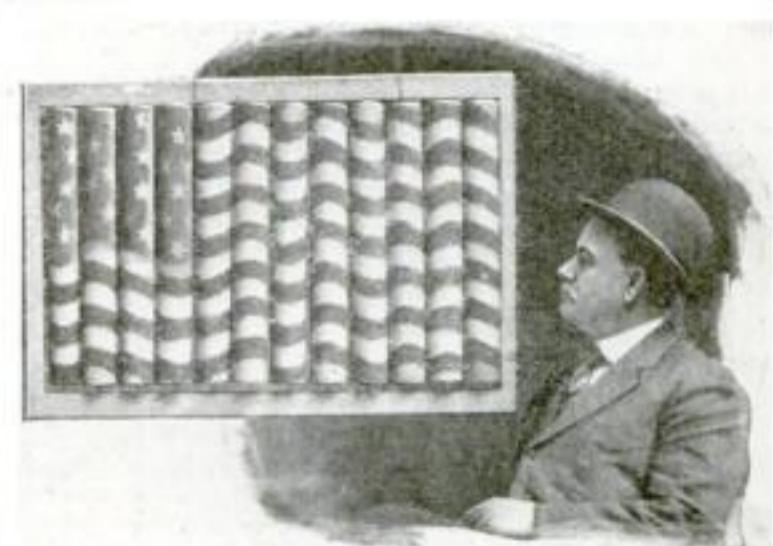
With this simple little device, which costs only a few dollars, the ambitious amateur photographer can achieve the same results as the professional portrait photographer. This process is known as soft focusing.

Mechanical Luminous Flag

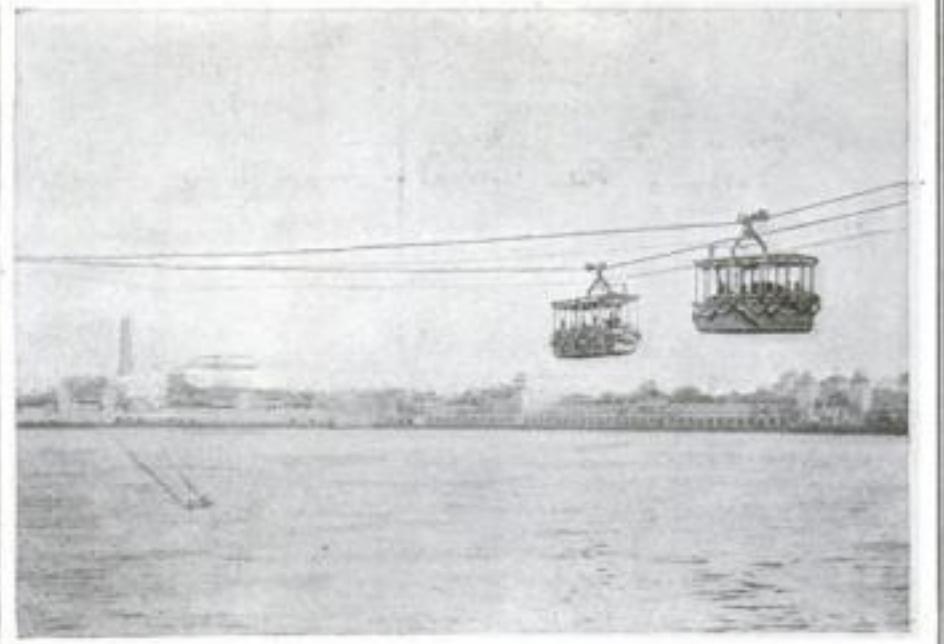
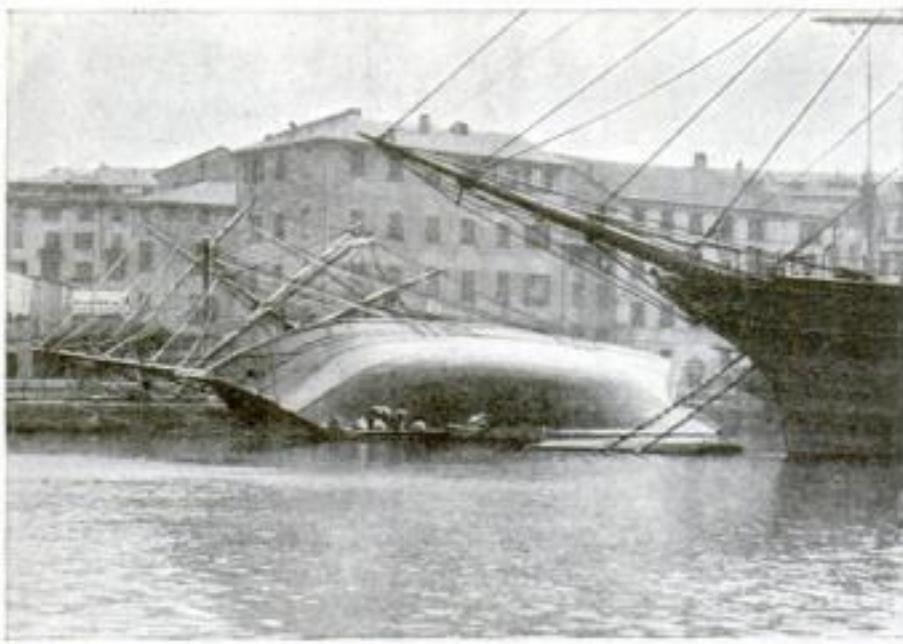
A NOVELTY in flags has been invented by James D. Houston of East Aurora, New York. It consists of a frame on which are mounted a series of glass tubes. These glass tubes have spindles formed on their lower ends carrying gears that mesh with a worm-shaft extending longitudinally.

The glass tubes are hollow and are illuminated by an individual bulb and reflector placed at one end of the tube. Each tube is painted in stripes or stars.

When these glass tubes are rotated, by actuating the worm-shaft that drives them simultaneously, an undulating effect is obtained that resembles a waving flag.



East Aurora, New York, is the birthplace of this flag



This Ship Was Painted Resting in Water

IF a ship has to be scraped and repainted, she is usually put into dry dock during the operation. But suppose there is no dry dock near; what then? Turn her over on her side, says the Italian Merchant Marine. The picture above shows one of Italy's merchant ships being treated in this fashion.

Before she was turned over, she was stripped of all fittings that might have been damaged by the water.

When one side of the ship is finished, she will have to be turned over and the other side will be scraped and painted.

As the "set" of hacksaw teeth wears during use, thus reducing the width of the cut, a new saw should not be used in a cut already started. It is better to turn the work over and start fresh.



Making Their Shoes for a Rainy Day

SOME parts of Chile have certain drawbacks that will forever debar them from becoming famous health resorts. Of such is the town of Chillan, which has a seven-months rainy season, when, according to the natives, it rains "twenty-five hours a day."

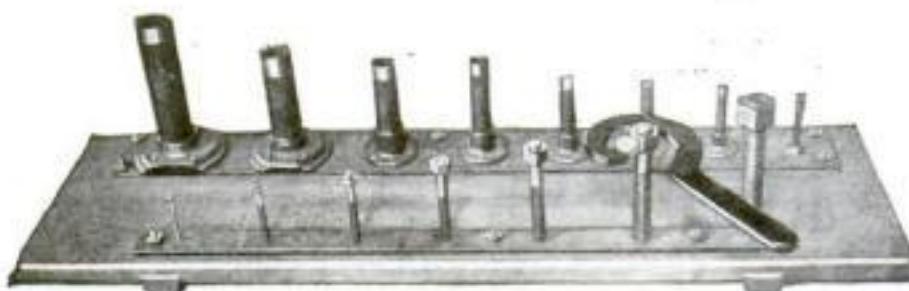
Which is the reason why the women in the picture have to work so hard. They are hammering leather tops to thick wooden soles, so that people can go around in the rainy season without catching their death. The leather tops are made in factories and the soles are made by local carpenters.

Here's a Wrench that Will Fit Any Nut

THIS Patent Office files are filled with patents granted on "universal" wrenches. Inventors have wasted a great amount of time and energy trying to solve the problem of the wrench, when, in fact, it has been no great problem.

It is not an adjustable wrench in the usual sense of the term, yet it will fit a nut of any ordinary size. It will not only do this, but it will also grip a pipe firmly and turn it—if it can be turned at all.

It is made in one piece—nothing to get out of order, nothing to break. The nut is gripped between the claw end of the wrench and the inner part of the circle.



How the one-piece wrench adjusts itself to nuts of every size

He Can Change His Clothes Under Water

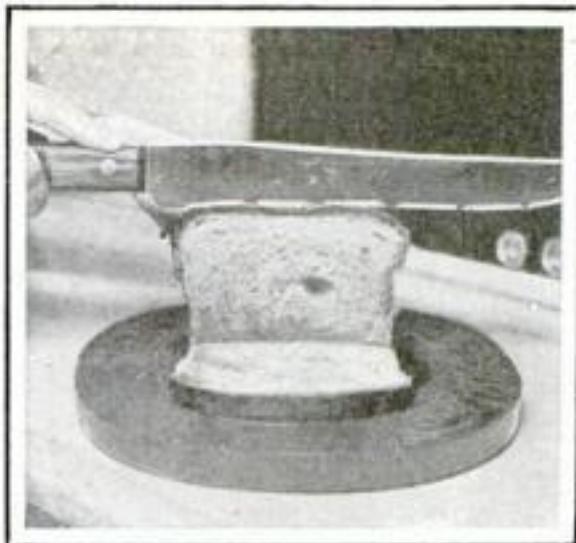
CONTRARY to the belief of people who don't swim, it is very difficult to keep the body entirely under water for any length of time. The tendency is to bob to the surface.

A San Francisco life guard has conquered this tendency to such an extent that he is able to undress himself completely while under water.

He jumps into the water fully clothed, from shoes to collar, and when he comes to the surface again all he has on is his bathing-suit. The picture below shows this extraordinary swimmer emerging after his undressing stunt.



A swimmer who can undress and dress under water



New Knife Cuts Bread without Creating Crumbs

BREAD crumbles if it is cut with a dull knife, and in some instances a sharp knife will do it too. What's the remedy for this? The knife that is shown in the picture above. Its edge is serrated at regular intervals, but the serrations slant in two directions. The set nearest to the handle slants toward the handle; the next set slants away from it. This is continued to the point of the knife.

At each stroke of the blade a clean cut through the bread is made. Very little pressure on the knife is necessary.

DID you know it is possible to engrave the surface of diamonds? A Frenchman devised tools by means of which it can be done.

Tea-Shop Sign Spouts Real Steam

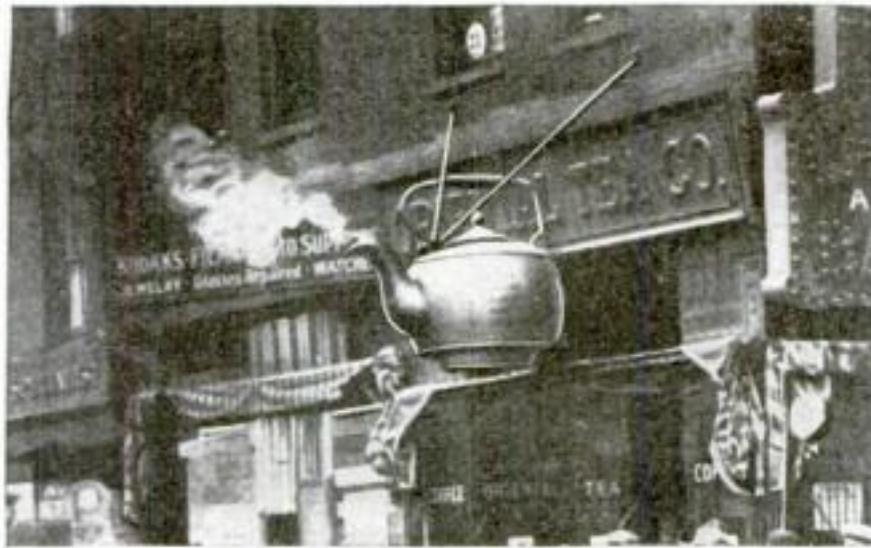
A BOSTON tea merchant hung a large tea-kettle in front of his shop. Inside the kettle he placed a stove and on it he put a small kettle filled with water.

A short time after the stove was lighted, the water in the smaller kettle began to boil and the steam puffed out of the large kettle's spout.

Passers-by stopped, looked, and then bought some tea.

The sight of that steaming kettle reminded them of their own kitchen stoves and of the half empty tea cannisters in their various pantries.

The kettle paid for itself in a very short time.



A Boston tea merchant's method of advertising

Side-Dump Service for the Truck

THIS new motor-truck body is designed for the use of contractors and specially adapted to serve the concrete-mixer in road construction. The two boxes are so mounted and balanced that they can be emptied at either side.

Each box holds sand and gravel for a three-sack batch mixture. The most efficient process is to unload the material from the freight-cars into a measuring hopper set high enough for a steady procession of these side-dump trucks to drive under. The trucks convey the sand and gravel directly to the cement-mixer without the delay or expense of any intermediate handling. The truck-driver need not leave his seat during the filling and emptying of his load.



A motor-truck body that is particularly useful in road construction

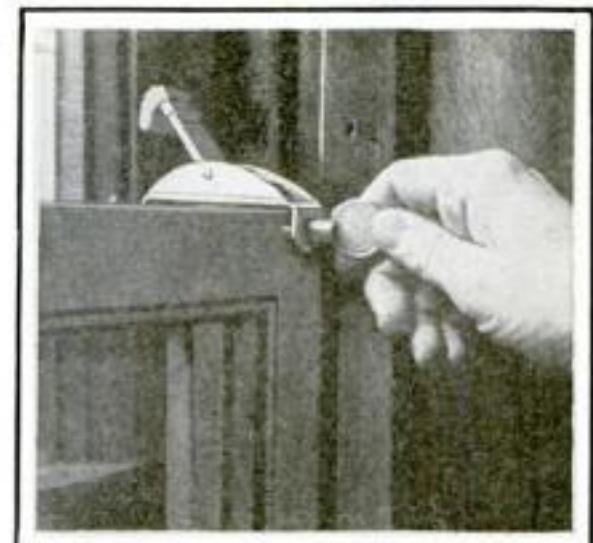
Book-Seller Adopts Peanut-Vender's Methods

STEVENSON wrote of "cabbages and kings." We write of peanuts and books because there is a European city where books are being sold after the best manner of the peanut-vender of the United States; that is, on a hand-cart that is wheeled from place to place as the necessity for a new market becomes apparent.

Book-sellers have tried to stimulate the public mind with a desire to own its books instead of borrowing them. This idea of taking the book to the street, right under the noses of the populace, is the most practical selling method that has yet been attempted.



Selling books in the same way as peanuts



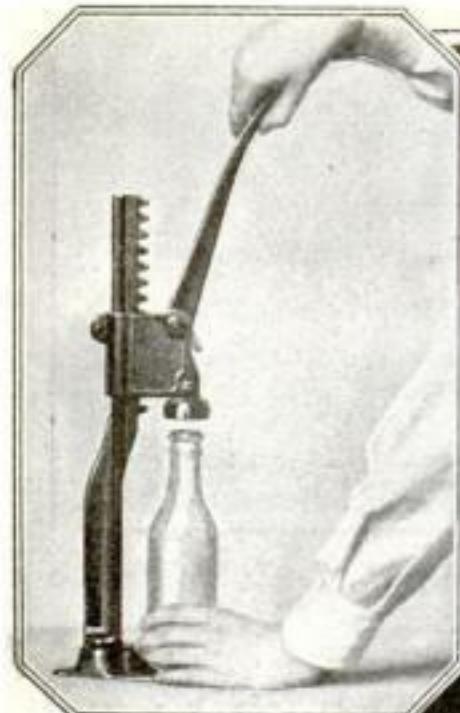
Automatic Lock Holds the Sash at Any Height

IF a window is equipped with the new lock shown above, it can be held immovable at any height.

This lock can be screwed into place on top of the lower sash by means of a coin. A steel lever edged with rubber touches the upper sash. After it has been adjusted, any attempt to raise or lower either sash will simply tighten its hold. The rubber edge prevents damage to the wood-work.

A NEW idea for conserving space in storing wheat hails from England. Crush or rough-grind the wheat, moisten it with steam, and pack it in blocks. In such form the grain would take up much less space than in the loose state.

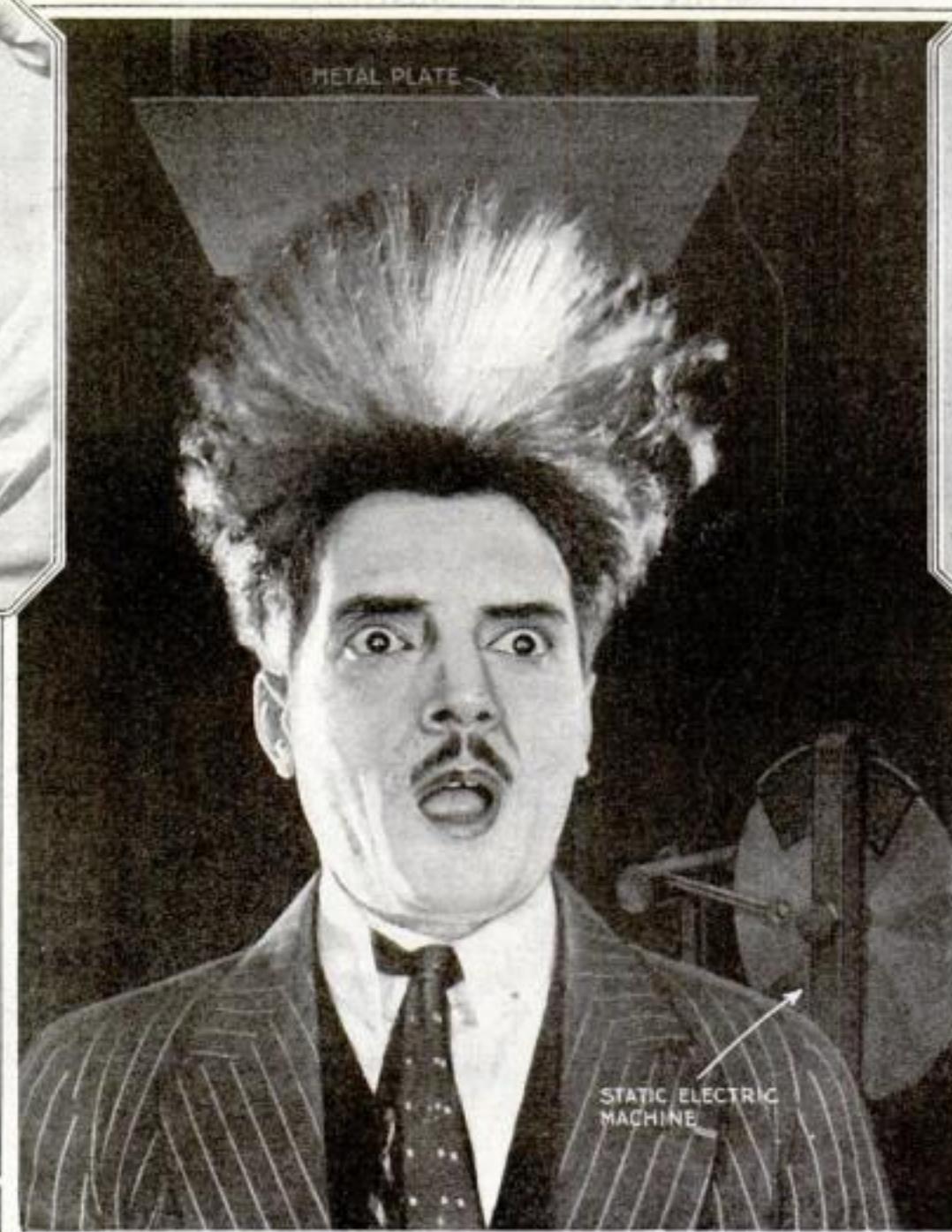
When needed for flour, the wheat "briquettes" would merely have to be crushed.



Easily Adjusted Bottle-Capper

A NEW bottle-capper, invented by Harry J. Lebherz, of Frederick, Maryland, consists of a base having an upstanding flange to hold the bottom of the bottle and a standard extending upward. This standard has laterally projecting vertical flanges and a rack portion. Plates engage slidably around the standard, and to these are attached a bottle-capper and the operating handle.

The handle, which is pivotally mounted on the plates, terminates in a small gear segment concealed within the plates, but of suitable size to engage the rack when the handle is in any but a vertical position. By raising the handle vertically, the capper can be quickly adjusted to bottles of different types.



Electricity Produces a Movie Scare

MOVING-PICTURE experts resort to every possible means to obtain certain effects. Electricity often comes to their aid. It was used here to make a comedian's hair stand on end. It is a simple little trick that may be duplicated with the aid of a static machine.

A metal plate is arranged so that the actor places himself under it. This causes his hair to stand on end in the manner shown.

ANY one looking at a map of Japan will see that it consists of several large islands and innumerable small ones. It is proposed to link two of the islands with a railroad tunnel, four thousand feet of which will run under the ocean.

This Camera Takes "Movies" and "Stills"

THIS French camera is for moving-pictures and for still views. The "movies" and the "stills" are taken on standard motion-picture films. It does not require a tripod and it is not operated by a hand crank. This new camera is operated by clockwork that is thrown into operation merely by pressing a button.

Fifteen feet of standard picture film is used in each load. An adjusting lever provides for the three classes of pictures, moving-pictures, time exposures, and instantaneous pictures. Two hundred and fifty separate views can be taken. These may be enlarged to a good size.



It takes "movies" and "stills"



A new spark-plug cleaner

Have Clean Spark-Plugs All the Time

WOULD you like to keep a set of clean spark-plugs always on hand? Here is a small metal box containing a rack to hold your spark-plugs. They are screwed into the holder and the compartment is filled with gasoline.

The top of the metal holder is then closed down and the whole apparatus placed in the tool-box of the automobile. As the car travels the vibrations of the machine shake up the liquid, and that cleans the spark-plugs. Thus it is possible always to have a fresh set of plugs, those in service being removed at intervals and substituted for the clean set.



Getting the Most Out of a Candle

CANDLES cost more than they used to—like everything else. A candle, like a cigar, will burn a certain distance of its length and the rest will be waste.

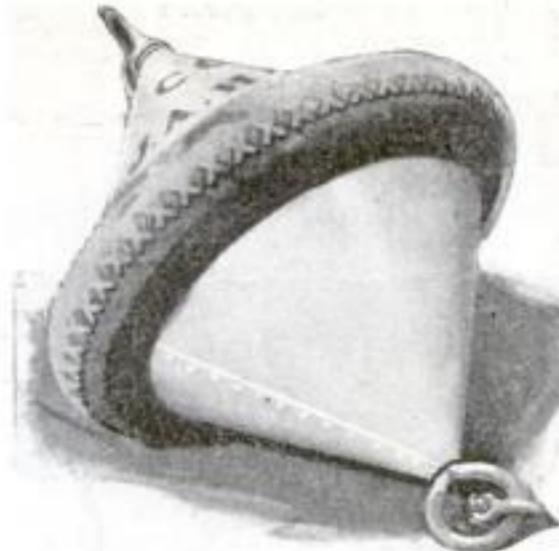
For one candle this waste makes little difference, but when a number of candles are used it is a different matter. In the average case, probably one fifth of the candle is wasted. By inserting three pins into the base of a candle the entire candle may be used.

WHEN Liège was taken in 1914, a monster gas-engine was in process of erection. It had four cylinders of 39 inches diameter, developing 8000 horsepower at 94 revolutions a minute. The Germans removed it but returned it at the end of the war.

Air Service Tries Out Tent-Hangar

TENTING on the old camp-ground" is the nightly song of three bombing airplanes stationed at the McCook Flying Field at Dayton, Ohio. They have no wooden hangars in which to spend the night, but are cooped up in one large tent that is supported by several tall poles.

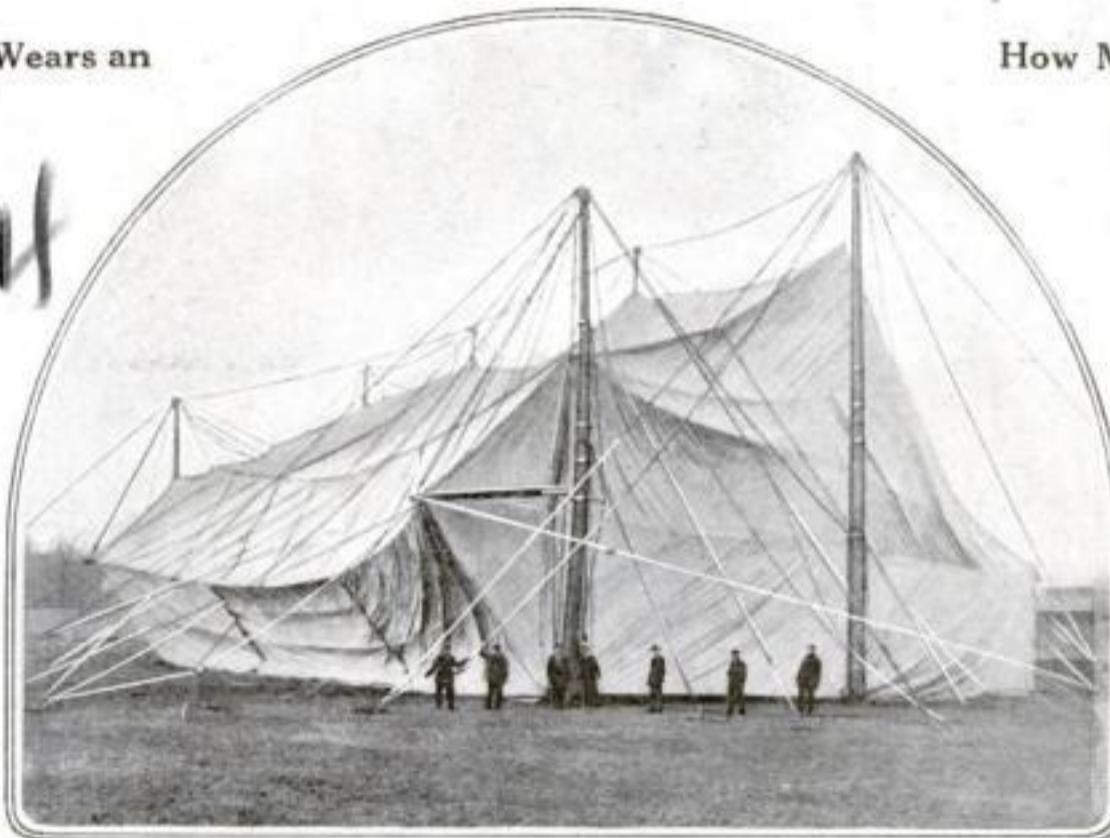
This tent is being tried out by the United States Air Service, and if it proves successful under all weather conditions, similar tents will be erected at various air stations throughout the country. The tent is thirty feet wide and one hundred and thirty feet long. The front of the tent rolls up in order to let the airplanes in and out.



This Seaplane Buoy Wears an Old "Shoe"

ABOVE is the photograph of an old automobile tire that went to sea after it was no longer useful on land. In what capacity? As a buffer for a buoy. It fits around the middle of a conical buoy and protects the seaplane attached to the buoy from possible damage. It has another important function — it gives the buoy additional buoyancy and eliminates the necessity of filling it with cork.

Seaplanes swing around in the water when there is the slightest wind. They are apt to bump into the buoys to which they are attached.



A tent-hangar now being tried out by the United States Air Service



How Many Telephone Calls Last Month?

HAVEN'T you often been dubious about the accuracy of your monthly telephone bill? And yet, with no record of the number of calls made, it had to be paid without protest.

But with the checking device illustrated, you can now keep tab on all telephone calls. Keep it near the telephone, and every time you make a call, press the lever. Presto! there is your record of the exact number of calls made. When the telephone bill comes in, you will have the satisfaction that every business man feels over a checked-up account.

Suppose He Should Sneeze!

ONE of the most striking features of a recent parade was the feat of Cameroni, the strong man, who, standing in the tonneau of an automobile, towed another car for two miles by means of a rope held in his teeth.

The performance of this iron-jawed gentleman in hauling the car for two miles through the traffic by his teeth would make a bulldog turn green with envy.

To the rope was attached an inner tube that acted as a snubber, besides demonstrating the strength of a modern tube.

If Cameroni had sneezed, or if the tube had snapped! But they didn't, and so the feat was considered a great success.

Testing Scales with an Automobile

BELLOW you see an automobile used to test the weighing accuracy of scales. It is not used merely to carry the official of the Department of Weights and Measures, but it is used as a unit of weight itself. It has a standardized weight.

This truck is equipped with a small hoist, so that the sealer of weights and measures may place a number of heavy iron weights upon it with very little trouble when large scales are to be tested. The truck is first loaded properly and is then driven upon the scales that are to be tested. The weight of the truck and its load is known, and if the scales do not register that weight the owner is sure to have an argument with the city officials.



Cameroni pulls an automobile with his teeth for two miles



This truck is used in a test when weights are investigated

Beacons to Guide the Midnight Air Express

New lighthouses planned by the government may make the transcontinental air routes safe

By James H. Collins

HAVING charted the first "model airway" between Washington and Dayton, the United States government will shortly install upon this route the first aeronautical lighthouse. If it meets the army tests, and if funds are forthcoming from Congress, the entire route will probably be marked with similar lights. Not only is the army interested in the establishment of air routes over the whole country for national defense, but also the Post Office Department, the commercial air transportation companies, and private fliers. The Post Office interest is probably keenest just now because lack of scientifically illuminated airways restricts the air mail service. For example, mail can be carried by day flight from New York to Chicago; but, for lack of lights to guide night fliers between that city and Omaha, it must be transferred to a train and picked up next morning at Omaha for another day's flight. Properly marked airways would make flight continuous.

The aerial lighthouse is the development of an international corporation that makes marine lighthouses. It has been worked out after much research and experiment, and involves some interesting principles.

Marine and Aerial Lighthouses

For example, a marine lighthouse throws its beams many miles, but in a very small vertical plane. Since the needs of sailors on a ship are met if the light is visible from water-level to a height not exceeding one hundred feet, the marine lighthouse is equipped with lenses to throw a thin disk of intense light to great horizontal distances.

To the flyer rising from the water in a hydroplane, however, the marine lighthouse would become invisible in a few hundred feet. Searchlights have been tried as flying signals, but at a distance of three to four miles these are visible only in a vertical range of about nine hundred feet, and then only in the direction in which the light is pointed. If revolved it is often



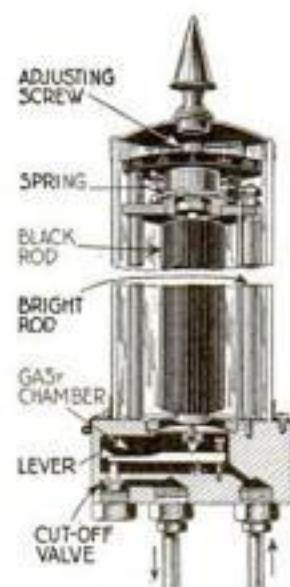
If the Congress of the United States votes sufficient funds, the government will mark the routes of airmen across the country with lighthouses and other distinguishing lights to make night flying safe

difficult to pick up.

The aerial lighthouse must throw a "mushroom" of light visible in every direction, and visible alike to the aviator anywhere from a

few hundred feet above ground to ten thousand or more feet. The light must be of about the same intensity at different angles, as well as visible at great distances. The requirement necessitated an original scheme of lenses to diffuse the light at different angles, and to provide a light of great intensity.

The light to be installed on the Washington-Dayton airway will be visible thirty miles. It is designed for stations forty miles apart, so that an aviator will always be in sight of one and usually two stations. About ten



The mechanism of the unattended marine light has been followed in the lights for airmen. The illuminant is acetylene gas, and it is burned in an incandescent mantle



This apparatus must throw a mushroom of light visible in every direction high in the air. Each light will be numbered to show its location, and will indicate its number in flashes

stations will be necessary for this airway, with additional lights on landing-fields. Each light will be numbered, and will indicate its number in a series of flashes.

Lighthouse No. 43, for example, would give four short flashes, then a short dark pause, then three short flashes, and a long dark pause to mark the beginning of the number, this combination being repeated continuously and automatically.

The mechanism of the unattended marine light is used in these air lighthouses. The illuminant is acetylene gas, the pressure of which operates the flashing apparatus. This gas is burnt in a diminutive incandescent mantle, and as the light may be left to operate by itself for long periods, provision is made for the replacement of broken mantles by a "mantle-exchanger." A mantle breaks. The flame burns up through the hole in its fabric and ignites a wooden stick. When this is burned,

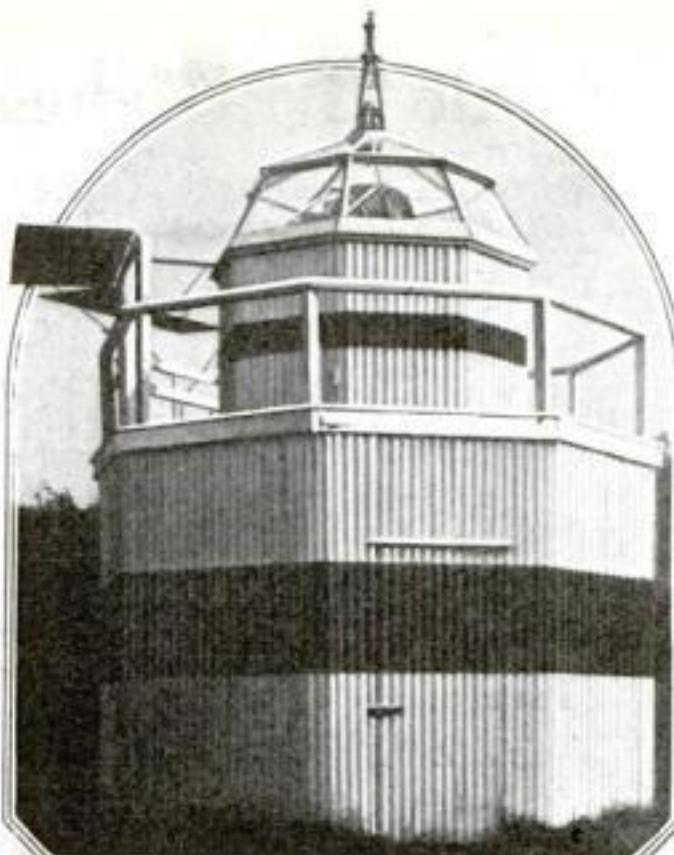
a spring is released, setting clock-work in motion, and a new incandescent mantle is brought over the flame. With a charge of four mantles, it is necessary to look after the light only once a month.

Darkness Is the Lamplighter

The "sun valve" mechanism of such marine lights is also to be used in the air lighthouses. This device extinguishes the light at sunrise and relights it when darkness approaches, regardless of the clock. Should a thunderstorm black enough to require the aerial light arise in daytime, it would also operate.

Inventors have devoted much thought to the development of trustworthy apparatus for turning lights on at sunset and off at sunrise, but almost invariably their devices are based on clockwork. Such mechanism must be adjusted to changes of the sun day by day, and will not operate on days dark enough to require a light.

The "sun valve" is as ingenious as it is simple, being based on the physical law that absorbed heat is absorbed by a non-reflecting surface. It is a system of metal rods protected by a strong glass cylinder. There are four of these rods, all made of the same metal, but the central rod is coated with lamp-black, absorbing heat, while three other rods surrounding it are polished and reflect heat. All four rods expand in the same degree under the influence of



The aerial lighthouse has been evolved by a marine lighthouse company. It is capable of throwing its beams many miles

heat, but only the central rod absorbs heat and expands under its influence. The expansion caused by sun-heat at dawn operates a valve that controls the passage of gas to the burner, closing it so that only a small supply is furnished for a pilot light. At the approach of darkness this central rod contracts, opening the valve and admitting to the pilot flame a stream of gas sufficient for the air lighthouse. By means of the sun valve, an aerial lighthouse is always lit when needed, while effecting a gas saving of 30 per cent.

Night flying will not only be

feasible when airways are illuminated in this manner, but experienced pilots declare that it will be easier than day flying. Day flying over unfamiliar country is not so simple as it might seem, there being no scientifically marked airways as yet. By day the aviator usually follows a railroad. To take the wrong branch at a junction or large transportation center is a common error. With night flying over a scientifically lighted airway, on the contrary, the aviator would always be in sight of a lighthouse, and usually two. By picking up the numbers flashed from these automatic signals, he would know in which direction he was going, his location, and the distance to the nearest landing-field.

These landing-field lights would tell him three things: (1) The location of the field. (2) The actual landing-place upon it. (3) The direction of the wind.

In landing, it is necessary to fly against the wind. The direction of wind is indicated by a huge weather-vane, turning on ball bearings with the wind. This weather-vane, shaped like a huge fish, is visible through flood lighting.

Who Maintains the Airways?

The job of equipping and maintaining airways is too big to be handled by the government alone; therefore towns along the Washington-Dayton route have been asked to provide landing-fields and service facilities.

Scrape the Peak off Coal-Storage Costs

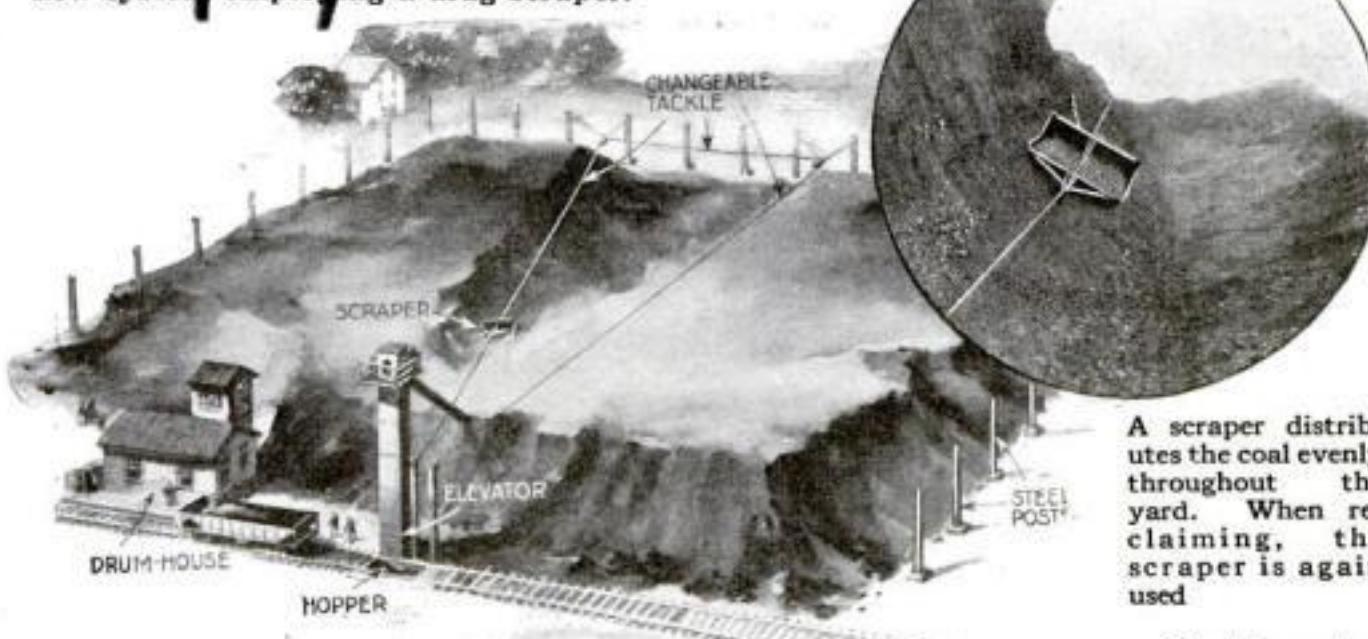
RAILROADS use at least three methods of storing coal: the trestle, the overhead crane system, and the locomotive or traveling crane method. Because of their cost these methods are being superseded by a new system employing a drag scraper.

This consists of a chain-and-bucket elevator where the coal is unloaded into a hopper below the tracks. The

bucket elevator picks up the coal and delivers it through a chute to form an initial pile adjacent to the railroad. If the coal is for stoking, a crusher is placed in the pit, where it can be used for crushing frozen slack coal in winter. A machinery house containing the driving-drums, to which are attached the ends of a steel cable extending over the storage-yard and having a scraper attached to it, completes the equipment, except for steel posts around the yard. The block and tackle holding the outer end of the drum cable may be shifted, according to where the coal is to be stored.

When reclaiming, the coal is scraped back to the reclaiming hopper and delivered to the bucket elevator, which will discharge the coal wherever needed.

By this system the storage area may be of any shape, even irregular. The elevator's first cost and maintenance are extremely low, yet its capacity is from fifty to one hundred tons an hour.



Coal is dumped from the car to a hopper below the tracks; it is carried up a bucket elevator and discharged through a chute into the yard

Painting Pictures with Light

American-made stained glass surpasses famous cathedral windows of Europe

By Latimer J. Wilson

THE maker of a stained-glass window is an artist who paints with light itself. The artist-designer first makes a sketch in color on paper or canvas. This sketch is then copied in color the full size of the window. A black-and-white cartoon is made the same size, and the sections of its design are laid out in patterns.

Since large windows must be reinforced by horizontal metal bars averaging one foot apart, the designer must be careful to arrange his patterns so that the bars will not interfere. For instance, to cut through the face of a figure would spoil it. The shapes of the pattern are then cut out of the paper with a two-blade knife, the distance between the parallel blades corresponding with the thickness of the lead strips to be used to hold the pieces together. These shapes conform to the folds of drapery, the shadows, and details of the design.

How Effects Are Obtained

Note how the lines divide the various parts of a stained-glass window. They are strong and dark in the foreground and faint and diffused in the parts that represent distance. If they were not thus softened, the distance would intrude itself upon the more important details of the foreground. This effect is obtained by partly concealing the lead strips that hold the pieces of colored glass together.

The lead strips are cemented to the glass and the window-maker calls this "glazing." In the part of the picture where distance is represented, to keep

the glazing from being too prominent two and sometimes three thicknesses of glass are superposed. The narrow lead strips are then placed between or back of the pieces, a single sheet of semi-opaque glass of the right color being fixed in front of the glazed portions. This opaque sheet diffuses the shadow of the lead strips and renders them scarcely noticeable. Hold up a piece of white paper on which a black pencil line is drawn so the light passes through the paper. The line will appear distinct when it is on the back. This illustrates the effect of keeping the lead strips on the back of the glass.

How is the colored glass itself made? Into a vessel containing molten glass—just plain glass of fine quality—are put certain metallic oxides. Copper is used for scarlet, gold for pinkish red, cobalt for blue, and tin oxide is used for milky white or opal glass. Without stirring the molten material it is poured out and run through a rolling-machine, which spreads out the colors in curious but haphazard forms.

Unlimited colored effects can be produced. Sometimes only one color—sometimes as many as five—can be used. If the color permeated the whole thickness of the plate it would be too dense for ordinary use. When not stirred, the color lies on the surface in a layer about as thick as paint.

To construct the final window from the original drawing the patterns of paper are pasted on a plate of plain glass standing upright so the light shines through the gaps to be occupied with the strips of lead glazing. Here an expert artist is required. He sub-



Pieces of colored glass are being cut to the patterns laid out on the cartoon. Care must be taken in selecting the colors and in cutting the glass

stitutes pieces of selected glass for the paper of the pattern. He must first select the "key" of his scale of tones. Sometimes this will consist of almost pure white for the lightest part of his design. Ordinarily it consists of a warm, yellowish white.

Judgment and Color Sense Necessary

Often accidental coloring in the multicolored sheet of glass will exactly fit the shadows or the folds of drapery in a design. The precise effect desired is sometimes obtained by using two or three thicknesses of different density. To select the proper section of the vari-hued sheet of glass demands trained judgment and a good eye for color. Peter F. Bell, of the Lamb Studio, has recently been awarded the highest American prize for artistic merit in this capacity by the National Arts Club of New York.

In the United States the art of making stained-glass windows has now reached a higher place than that attained by the famous windows of European cathedrals. Credit for this advancement must be given the late John La Farge and F. S. Lamb.



Here some of the pieces of glass have been painted and are being put in the kiln for firing. Complicated details and the faces of the figures must be painted on



The glazier fits the pieces of colored glass together after the manner of a child's puzzle. Lead strips are cemented to the glass with a substance that is waterproof

1921 This Easel Finds a Place in Any Room



Invalids may have the easel placed beside the couch, bed, or chair, and have meals served on the table-like bracket or shelf. It will also serve as a writing-desk or a book-rest



For dwellers in small apartments this combination easel, which occupies little ground space, is extremely useful. Here it is shown in the rôle of a dressing-table and shaving-stand



The woman who likes embroidery and other needle-work and wishes to devote her spare time in the evenings to it, will find this easel very useful. Her work rests on the shelf and receives a good light



Here this protean piece of furniture is shown in the part for which easels are primarily intended—to support the stretcher and canvas on which the artist paints

Learning to Swim in Vienna

FAATHER threw me overboard." That's the answer many boys will give you when you ask them how they learned to swim.

But the fathers in Vienna don't treat their sons in such rough fashion. The boys are sent to a swimming-school, where they learn first to "swim" on land. They put on their bathing-suits and lie across straps that are attached to the sides of wooden frames. There are two straps on each frame, one supporting the abdomen and the other fitting under the arms. While in this position each boy is taught the breast stroke and the proper foot action. He is kept at it until he unconsciously does it correctly.

Then he is given a tryout in the



© Keystone View Company
In Vienna the boys are taught how to swim on land before they attempt the water



© Keystone View Company

After sufficient land practice the boys try the water. They wear life-belts attached to overhead pulleys

water. He wears a life-belt that is attached by a rope to an overhead pulley. Thus the problem of "staying up" is eliminated while he grows accustomed to the water. He practises in shallow water with instructors on all sides of him, and is soon able to swim without the aid of the pulley.

The illustrations give a clear idea of the methods employed in this Viennese swimming-school. Never will a boy have fear of the water after such a training.

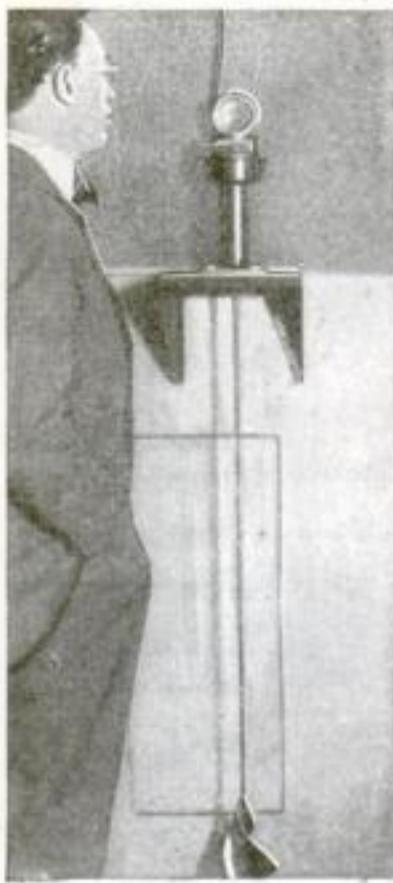
How Wireless Is Helping the Farmer

IN various parts of the country farmers may now have the benefit of the latest market reports, sent out daily by wireless. This is made possible by the cooperation of the Air Mail Radio Service of the Post-Office Department with the government Bureau of Market Reports.

At present the plan is to send out reports as follows: From Omaha each day, a report of the Omaha live-stock market will be made at 11.15 A.M. (Central Standard time); at 11.45 on the Kansas City live-stock market. At 2.15 P.M. a grain and potatoes report will be sent out, giving prices and conditions at Chicago, Minneapolis, Kansas City, and Winnipeg. And at 5 P.M. a "Daily Marketgram," covering national market conditions on live-stock, fruits and vegetables, grain, hay, feed, and seed, will go out.

Similarly, reports from St. Louis: at 11 A.M. a National Stockyards report; at 11.30 A.M. a Chicago live-stock market report; at 2 P.M. a grain and potato report; and the Radio Marketgram at 7 P.M.

It is hoped that these reports will be picked up by amateur radio operators within the three-hundred-mile radius of each station. There are also hundreds of licensed operators in the areas covered, and the Bureau of Markets hopes that these operators will receive the reports and see that they are placed in the hands of interested persons.



Reading a Water-Meter by Telephone

THE water-meter can be read over the telephone. That is a good step-saving idea for the irrigating farmers of the West.

There is a revolving pointer on the water-meter and there is an electric connection between the water-meter and the telephone. As the pointer revolves, there is produced in the distant telephone receiver a distinct click.

The number of these clicks a minute will give the amount of water flowing through the ditches.

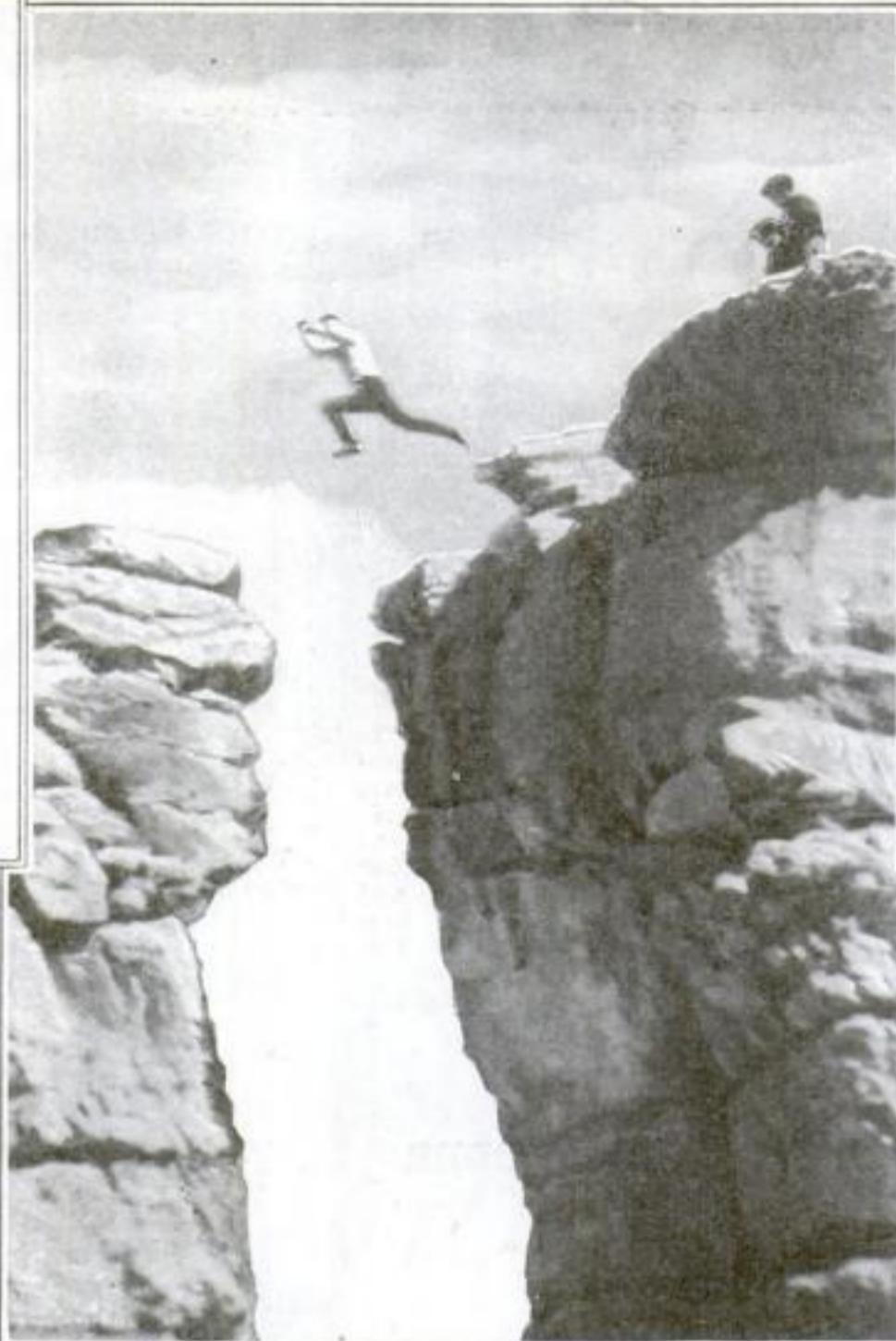
Keeping Your Cap in Shape

ORDINARILY it is necessary to stuff a cap with paper to keep it in shape. William H. Moore, stationed on Governor's Island, noticed the trouble the soldiers had with their caps, so he devised a metal strip to put inside.

The cap on Mr. Moore's head contains a metal form similar to the one he is inserting in the brim of another cap. Two small clips adjust the thin band of metal.



This strip of metal keeps caps in shape



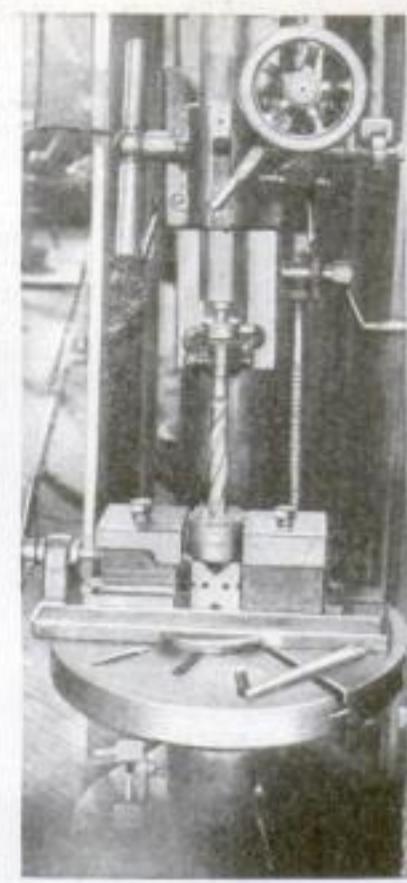
He Is Leaping Across a Four-Thousand-Foot Chasm

IMAGINE a chasm four thousand feet deep and sixteen feet wide; would you leap across it? Probably not, yet here is one foolhardy man who did it. His name is Walter Duncan and he is presumably convalescing in a hospital in Arizona.

During the war Duncan was with the Fifth Division and he undoubtedly finds life in a hospital very tame—hence the leap. The photographer caught him in the act, as the picture above shows.

A sixteen-foot jump, however, is well within the world's record for the running broad jump, which is nearly twenty-five feet. The record standing broad jump, on the contrary, is less than sixteen feet.

HERE is an instance of cooperation between the sea and the air that will delight the larger-air-force enthusiasts. A torpedo was lost from a vessel during practice. For two hours a navy airship looked for the torpedo before it was spotted with its nose sticking out of the water. The airship signaled a destroyer and dropped a smoke bomb to show the location of the torpedo. Thus a valuable bit of naval armament was salvaged.



Accurate Holes Assured with This Tool

WHEN the machinist has a hole to re-bore or ream out he must see to it that the drill or reamer is held in such a way that it will not produce an elongated hole. If the drill were held firmly without being allowed to sway a trifle, an accurate hole would be very uncertain.

This special holder is held so that it will not slip, but is free to move from side to side. Thus, when a drill is placed in a hole that is to be bored, the larger hole will be exactly concentric with the first smaller hole.

Rat-Traps for Ships' Hawser

RATS run up and down the hawsers that hold ships in place. Hence we now have the hawser rat-trap shown below.

This trap clamps around the cable and has an inviting trapdoor at each end. The rat travels up or down the rope until he reaches the trap; without hesitation he goes through the door and drops to the bottom. There are flexible wire prongs that bend inward at each door.



Unsuspecting rats fall into this hawser trap



Golf Machine Measures Length of Drive

PRACTISE long drives on the roof, says Maurice McLaughlin, the famous tennis-player, who is also a golf enthusiast. He is shown herewith demonstrating a new golf machine that enables you to tell how far your ball would have traveled had it not been held back by the cord to which it is attached.

The machine fits in a corner of the roof and is no larger than a traffic post. On top of the stand there is a dial that registers the force of a stroke delivered to the ball that hangs at the end of a cord.

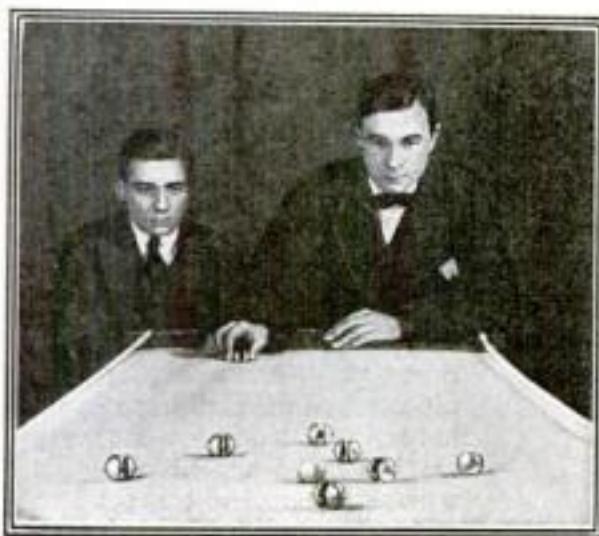
Such an instrument as this drive recorder will be welcomed by those golf enthusiasts who live too far from the links to get there for a game more than once a week.

Domesticated Bowls

INDOOR bowling is a game in which tenpins are knocked over by large metal balls—known as bowls. Outdoor bowling is an entirely different game. The object is not to knock over tenpins, but to hurl the bowls as near as possible to a white ball known as the "jack."

And now this outdoor game has been brought indoors; it is played on a table in the manner shown below.

The white "jack" may be seen in the foreground and several bowls are seen lying around it. The players—there can be any number—are arranged in two teams. Each team has a captain.



Outdoor bowls are here brought to table



This Movie Camera Is Equipped with a Motor

"WHY didn't I think of that?" many of our readers will moan when they see what Frank Morris has done for aerial movie photography.

For Morris has eliminated the three cranks—and cranks they were—in more senses than one—of the movie camera, and in their place he has put a battery of eight-volt, sixty-ampere power that has only to be started and the photographer can "shoot" in any direction desired with the assurance that the film will grind out smoothly.

Note the air cushion that the operator is wearing; it is a shock-absorber.

SAD is the story told by the *Army and Navy Journal*. Some one has been tampering with the alcohol sent to submarine bases for the torpedoes. Somewhere between the point of shipment and the base, that pure alcohol was diluted.

So now all navy alcohol must be analyzed at its port of embarkation and again on its arrival at its destination and the two analyses compared. Also whatever ethyl alcohol is used on shipboard must be denatured with croton oil and colored with a dye under the eye of the medical officer.

Over the Water in a Horse-Car

BOTH ferry-boat and a horse-car is the vehicle above. This particular horse-car is used on the flooded beach of the German island of Langeoog. It is probably the only horse-drawn car in the world that makes its way through the water as well as over the land.

Don't think that it is a boat as well as a car. It does not float; it runs on rails laid under the water. It would be impossible to use an electric car for service of this nature. The water would get into the motor and the passengers would certainly have to finish their journey by walking.

At first glance this car reminds one of the English and French bath-houses that are taken a short way out to sea before their occupants make their appearance.

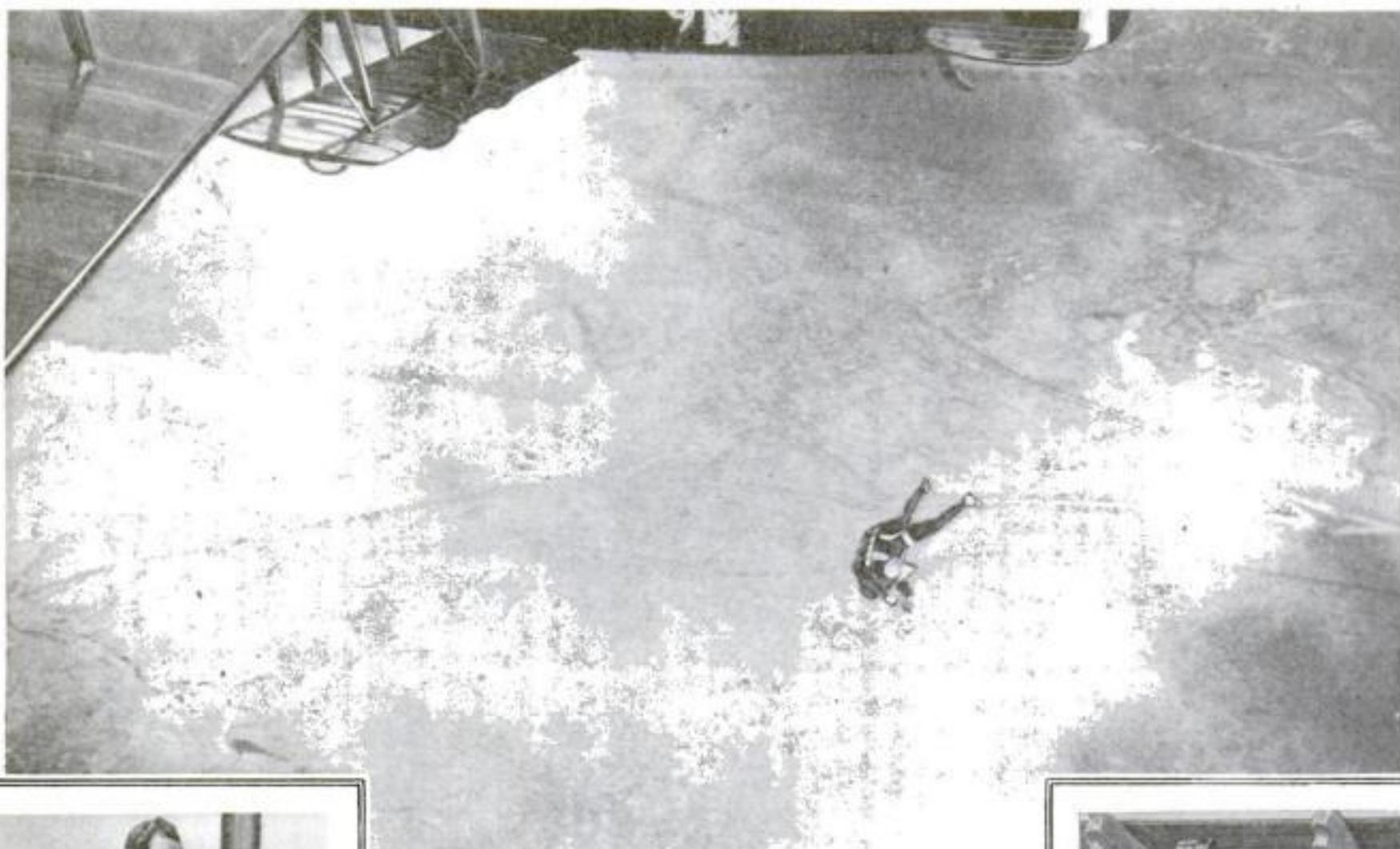
Keeping Back the Dross

HOT metal in a crucible presents a number of problems. It is constantly giving off fumes that are in many cases injurious to the health of the foundry workers. If a cover is placed over the crucible, then the workman cannot scrape the dross off to prevent it from getting into the mold.

A cover has at last been invented that not only helps to keep the metal hot, but also prevents the dross from getting into the mold and causing unsound castings. A graphite "skimmer bridge" is placed on the bottom of the cover so that it will be at the lip of the crucible. This holds back the dross, but allows the hot metal to pass.



Dross cannot pass this crucible cover



Falling Four Miles through the Air

THE first hundred feet are the hardest in the life of a paracutute jumper. He falls through the air, arms and legs sprawling in the manner shown above, until his paracutute miraculously opens up.

This picture was taken at Post Field, Oklahoma, when Sergeant E. Chambers made a spectacular jump from a height of nearly four miles! He is shown diving head first for the earth far below.

Chambers fell five hundred feet before his paracutute came to life—after that all was clear sailing.

It Is Impossible to Sink This Boat

YEET another non-sinkable boat has appeared. Boats of this nature are all equipped with special sealed air-chambers that are able to sustain considerable weight.

This particular boat is one big air-chamber in itself. The entire bottom of the boat is used to form an air-chamber. A false bottom is built in the craft and the space between this and the real bottom of the boat forms the air-chamber.

The picture below shows the new craft being tested in San Francisco bay. The lifeguards are trying to sink it by turning it over. This is impossible, however, since the craft is provided with a very heavy keel and it will right itself immediately.



© Keystone View Company

Trying to sink an unsinkable boat; a hopeless job

Electric Sandals Find Current Leakage

ASERIOUS problem in connection with the superintending of any electric power scheme is the finding of defective insulators. Many methods have been suggested, but until now none could be carried out without temporarily stopping the operation of the plant.

In order to detect leakage by this new method the operator wears a pair of metal sandals connected with a hand telephone by flexible conductors. Thus equipped, he walks along the row of wire-carrying poles, listening to sounds in the telephone. He is thus able to determine not only the magnitude of the leak, but its direction.



For Boring Holes Overhead and Out of Reach

SHOWN above is a boring-tool that is just the thing for boring holes overhead and otherwise out of reach. The bit, mounted on the end of a long rod, is actuated by a ratchet arrangement with a strap drive. The workman pulls on the strap and the bit does the rest.

The bit is so arranged that it can be made to bore a hole at any angle.

The handle upon which the bit is mounted is adjustable, so that holes can be bored at different heights. The old method of climbing upon a ladder and using an ordinary ratchet brace-and-bit is crude when compared to this modern method.



This Automobilist Wears a Mask while He Races

THE calm, healthy driver of a racing automobile is a changed man after he finishes a race. He staggers from his place at the wheel—body fatigued, face lined and drawn. Perhaps his face is cut by flying splinters that have been chipped off the board track during the race.

Roscoe Sarles, a well-known driver, has had several unpleasant splinter experiences in the past. In consequence, he wore at a recent Los Angeles race a strange mask made of chamois.

The mask completely covers his face and yet is so made that he can breathe easily. This is done by means of stiffened flaps that hang over the holes for the nose and mouth.

Goggles are worn to protect his eyes.



Seen from the Nevada's guns at target practice

Geysers from Twelve-Inch Guns

AIMED at one target were ten twelve-inch guns and they were all fired at once. The picture below shows how accurate the shots were. Ten huge geysers burst into the air within a few yards of one another!

The three guns in the foreground did not participate in the shooting. They are mounted on the *Nevada*, which acted as a towing-ship for the target during this maneuver. Secretary Denby was standing under the guns when this picture was taken.

The ships that fired the shots were the *Utah*, the *Delaware*, the *Florida*, and the *North Dakota*, all belonging to the Atlantic Fleet.



Breaks All Diving Records in Steel Tube

LOCKED in a cast-steel tube fifteen feet long, thirty-eight inches in diameter, and weighing five tons, A. E. Chisholm was lowered into the water. He went down four hundred and forty feet and stayed there half an hour, thereby breaking the previous deep-sea diving record.

This tube carries its own air supply, and Mr. Chisholm, the inventor, claims that a man can remain in it for four hours. The tube is lowered by a donkey-engine and cable.

A metal arm, with a steel hand at the end, reaches out from the side of the tube. This arm is controlled from within and it will do all kinds of work, from tying knots to lifting metal bars, making the invention especially valuable to divers.

His Trunk Is His Dressing-Room

WHEN the lid of a trunk is opened, it is apt to reveal almost anything. In the picture below you see a strange trunk that, when opened up, becomes a dressing-room. The trunk belongs to a very young actor and it contains everything he needs in his business.

Inside the lid of the trunk there is a mirror, an electric-light fixture, and a collapsible dressing-table. The body of the trunk is divided into drawers that contain clothing and cosmetics. When the owner wishes to "make up," he pulls out the bottom drawer and uses it for a seat.

CALIFORNIA redwood may be artificially carved by sand-blast. Portions of the surface are covered by protective stencils and the design appears in relief against a uniform stipple background. Most of the work is done in the color of the redwood.



His trunk becomes his dressing-table

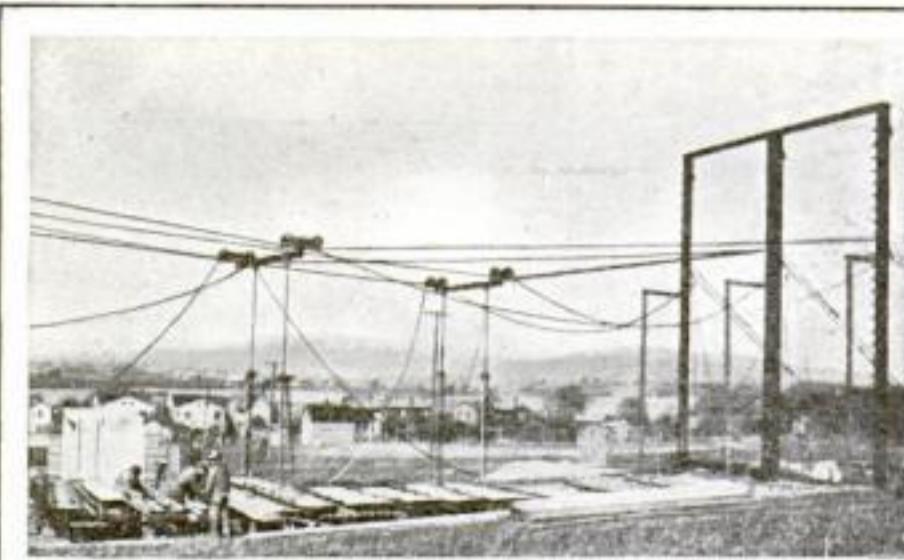
Finding the Tension for Piano Wire

FOR tonal analysis of pianos a synthetic instrument was devised, consisting of a series of tuning-forks.

By means of a master fork (shown in the lower right-hand corner of the illustration) having a platinum make-and-break, the entire series is actuated, and by means of a series of rheostats the current to each fork is controlled. Increasing or decreasing the intensity of vibration of one or more of the forks changes the quality of tone.

The illustration shows a man comparing the synthetic tone produced by the electric-driven forks with the tone produced by a piano wire of the same pitch mounted upon an electrical sonometer.

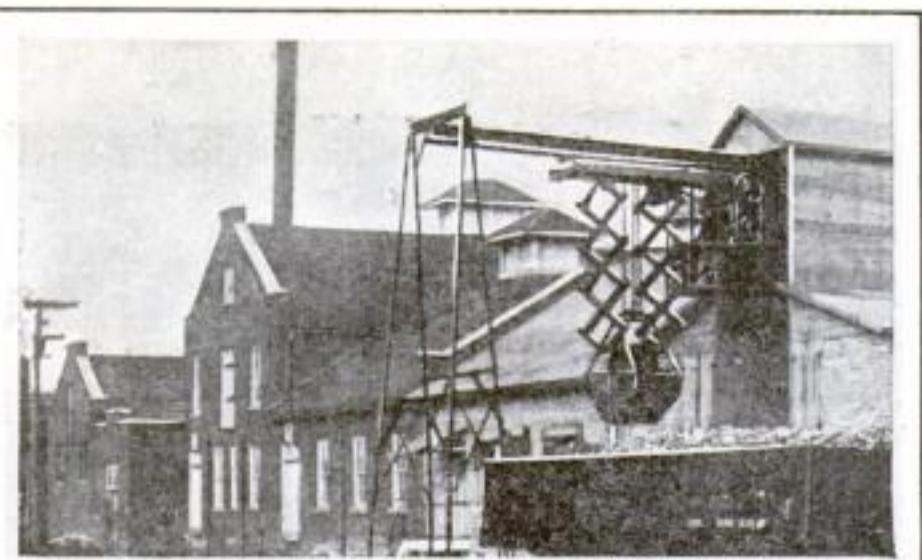
As a result of much research and experimentation it has been demonstrated that piano wire is at its best acoustically at a tension of 160 pounds.



Trolleys to Carry Concrete Building Slabs

SHOWN above are trolleys that carry huge concrete building blocks in cradle fashion from place to place. They travel on heavy cables and have strong rails attached to them. At the other end of each rail there is a second pulley to which are attached the cables that hold the great blocks.

Walter S. Painter, of New York city, invented this trolley system for use in the construction of large buildings. The main cables extend the full length of the building under way and the concrete slabs are carried directly to the place where they are to be erected. Cables are used for pulling the trolleys along the main cables.



Extension Arms Operate this Light Clam-Bucket

HERE is a clam-bucket that is raised and lowered by a new type of extension arm which holds the bucket down while the loading is going on. Thus a very light bucket can be used and the cost of the entire conveyor is appreciably lowered. The ordinary bucket must be heavy enough to dig down of its own accord; hence a bucket that would hold a ton of coal would have to weigh two tons.

The new bucket, according to its manufacturers, lowers the cost of every carload of coal fifteen dollars. The operator travels with the bucket in a small cab; thus he is able to pile the coal accurately and quickly.

Chicago Provides Its Policemen with Forts

THE general public seem to take a policeman's bravery for granted, but there are some of us who have marveled at the spirit that makes him forget himself, wife, and children in the presence of danger and plunge into the midst of whatever trouble has arisen.

Chicago has decided that its police are not going to take unnecessary risks in the performance of their duty and has provided them with portable "forts" for use in fighting criminals who are resisting capture by barricading themselves in an advantageous position.

A steel screen ten feet high and four feet wide provides protection for two men.



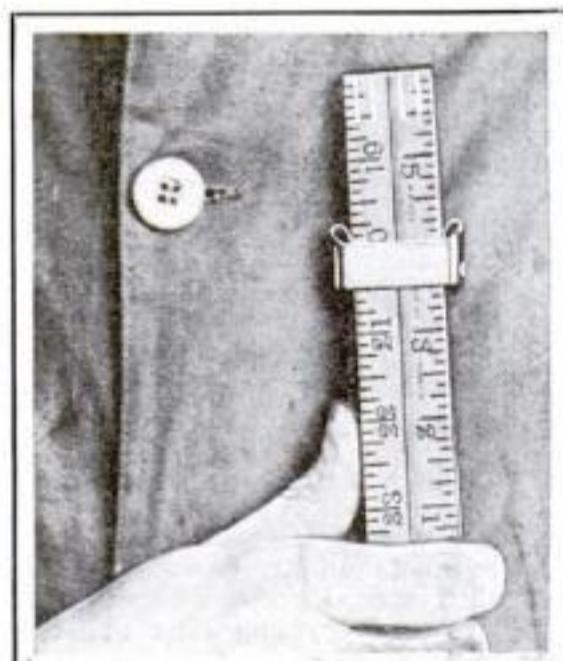
Waterproof Cover for Hat

FRANCE, of course, thought of this clever hat-cover for rainy weather. Clever, because although it serves a utilitarian purpose, it has not lost every vestige of style, as have so many of our storm garments, such as raincoats and rubbers, though it is only fair to admit that in recent years rubbers have achieved a certain style, particularly those worn by women.

The hat-cover is made of rubberized silk. It is intended especially for straw hats and is fastened under the brim by a running cord that can be adjusted to fit. The touch that puts "Paris" on the hat is the silk band.



Chicago policemen with bomb and gun and armored screen



Clip for the Carpenter's Ruler

A CLIP for holding the carpenter's ruler has now been invented. There is a safety-pin on one side of the clip that enables the carpenter to pin it on to his coat. Thus the ruler is always handy when he needs it.

The clip itself is a simple affair—made of a strip of metal bent into oblong shape to fit the ruler. There is a curved metal attachment at each end that prevents the ruler from slipping.

TWELVE thousand dollars was paid at an auction sale in Paris for the first Mauritius twopenny stamp, which is the most popular, though by no means the rarest, of the valuable postage-stamps. It was engraved by a watchmaker in 1847. Only a thousand were issued, and of these but twelve are still in existence.

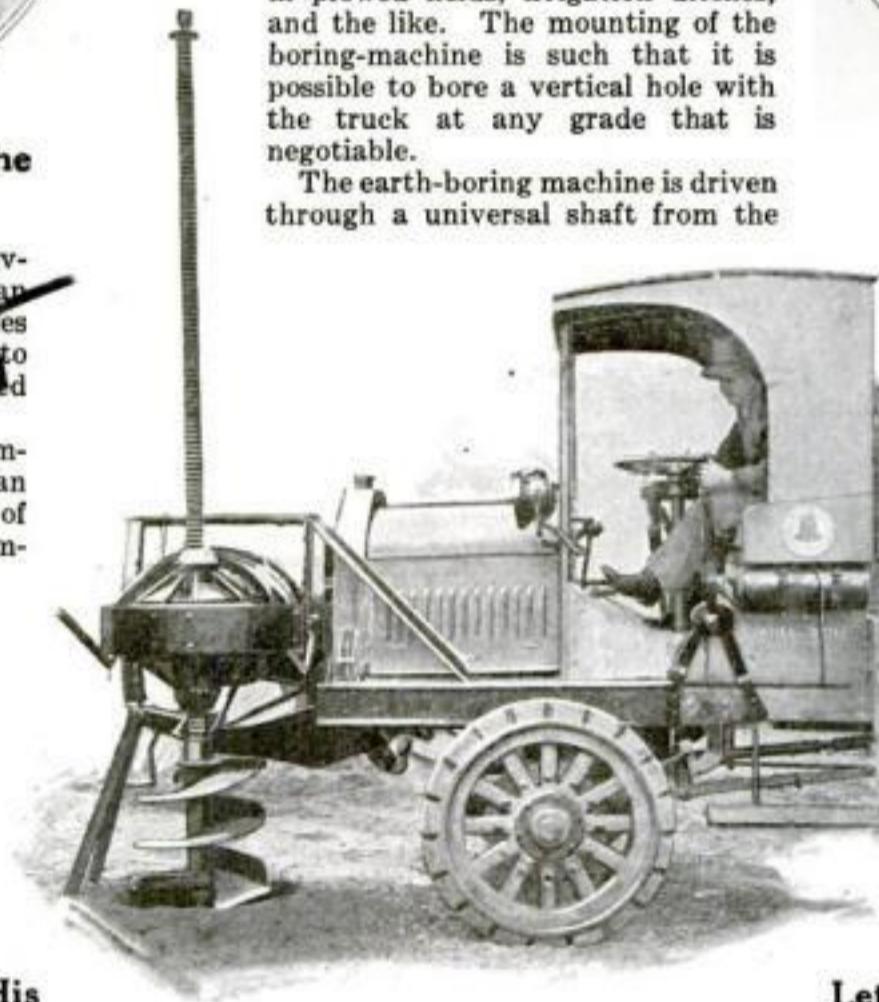


How Coal Is Tested for the Bureau of Mines

WHEN the United States government buys coal, it sends an engineer from the Bureau of Mines to see that the coal delivered is up to the specifications the mine submitted to the purchasing agent.

While elaborate analyses are employed, the expert in the picture can reach a very fair approximation of the grade of coal with the comparatively primitive tools he is using.

A sieve, a hammer, a brush, and a good deal of experience and technical knowledge are his implements. If he detects any signs of inferior quality, a scientific analysis is made, and if the coal is not up to sample it is rejected.



This auger is strong and a quick worker

Baby Can Now Have His Automobile Crib

PROUDLY you exhibit your son in his new automobile crib. Your friends appear equally enthusiastic about the baby and the crib, and they are hardly to be blamed. The crib is compact, comfortable, and absolutely safe.

The crib is fastened to the robe rail, or, lacking the rail, strap loops are provided. A strap carrying a ring is screwed to the floor; the ring is fastened to a spring that hangs from the frame of the crib. This spring is what makes riding so smooth for the child; it holds the crib away from the front seat and gives that springy motion which soothes the baby and keeps him in a good temper and in consequence gives his mother more leisure.

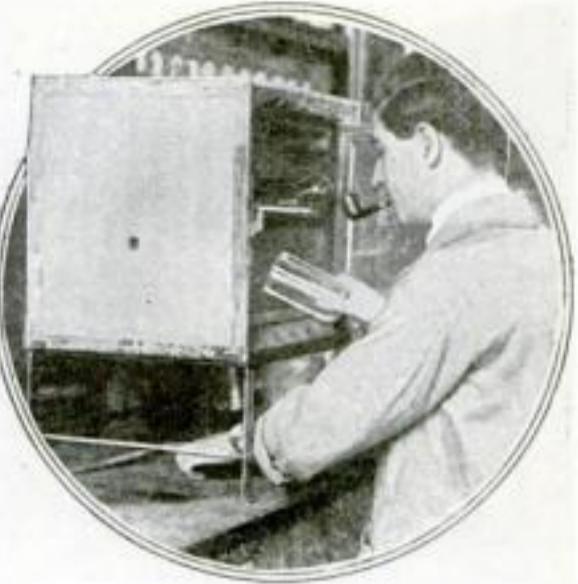


Baby is as safe in the car as at home

It Digs Post-Hole in Seven Minutes

IN 1914, when the first transcontinental telephone line was being constructed, an improved method of boring post-holes became desirable, and a power-driven auger mounted on the rear end of a horse-drawn wagon was put into use. It was slow and unsatisfactory, and has been replaced by a power-driven earth-boring machine mounted on the front end of the chassis of a motor-truck. Because of the fact that the pole line invariably extends "cross-country," a truck having a four-wheel drive is absolutely essential to enable the truck to negotiate the surface encountered in plowed fields, irrigation ditches, and the like. The mounting of the boring-machine is such that it is possible to bore a vertical hole with the truck at any grade that is negotiable.

The earth-boring machine is driven through a universal shaft from the



Sick Arc-Lamp Globes Go to Hospital

ACTINIC rays of an arc light will gradually turn the glass of the globe purple, which seriously interferes with the illumination produced. The globes used in arcs designed for photographic use become almost black in a few months, and must be replaced, even though they are otherwise in perfect condition.

Although the purple coloration is not confined to the surface, but extends throughout the thickness of the globe, it is being removed by heating the globe in an annealing furnace to about 1000° F. After cooling, the glass becomes as clear as a new globe.

Letters Are Reduced in Size for the Air Mail

JUST as the letters carried by the old transcontinental Pony Express were written on tissue-paper to save weight, special methods are now being used to permit airplanes to carry more mail than is possible with ordinary sized letters.

By photographic methods, the average business letter may be reduced to the size of a postage-stamp.

The letter is photographed in a reducing camera and the tiny negative is what the airplane carries. Upon delivery, the recipient puts the letter in a lantern that enlarges it so it can be read.

A similar method is used to preserve official records in order to reduce the storage space that they formerly occupied.



The letter will be the size of a stamp

Tagging the Fishes

THE Ministry of Agriculture and Bureau of Fisheries of Great Britain have been conducting some interesting experiments in the tracing of fish and the directions of sea currents. From certain

stations in the North Sea bottles containing a postcard have been cast adrift. The finders are requested to mail the postal. From the data thus obtained much valuable information may be secured regarding ocean drifts and the movements of floating fish-eggs.

Fish have also been tagged with a small disk, which the finder is asked to return, with the place and date of finding.

From the Cocoon to the Department-Store

SOME forty-five hundred years ago the silkworm was the pet of the royal family of China; it is said that a Chinese empress invented the first loom. However that may be, it is true that China was the cradle of the silk-worm industry. The average life of the silkworm is thirty days and in that time it spins about four thousand yards of its valuable silk thread.

~~Silkworms' eggs are usually imported from China, where the healthiest eggs are produced. Disease spreads like lightning, therefore breeders get the best specimens they can.~~

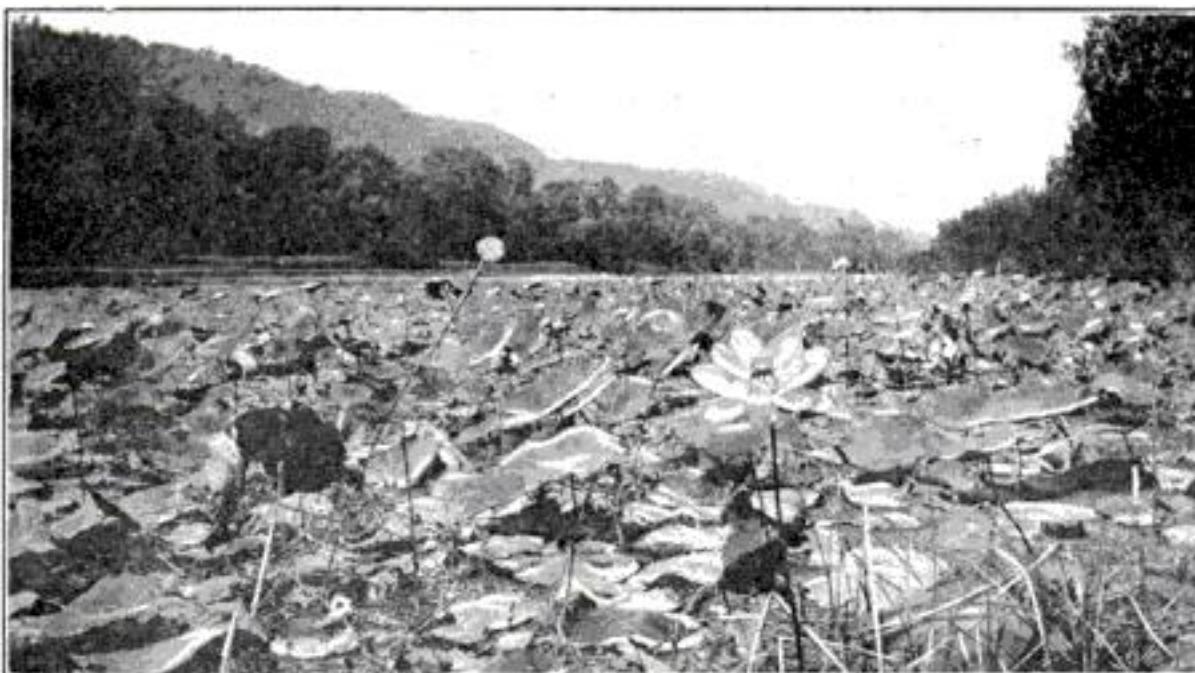
The eggs are kept in incubators for thirty days, when they hatch out. The young worms are put in wicker trays with some mulberry leaves, their favorite food. After molting four times the silkworm spins its cocoon, which is of a double silk fiber that is discharged from two glands under the worm's lip.

~~After the cocoon is spun and the silkworm is in the process of becoming a moth, the best cocoons are selected for breeding. The male moth is indicated by a redlike cocoon, the female by an oval cocoon. The moth emerges in about two weeks and mates almost immediately. The female lays about four hundred eggs and dies.~~

Cocoons not selected for breeding are steamed and then steeped in hot water. This melts the gelatinous substance that holds the silk so compactly and permits the thread to be wound.



George Julian Zolnay, the sculptor who has invented the new synthetic stone, making possible a perfect but inexpensive reproduction of the Parthenon frieze. With his new material he has reconstructed the ninety-six metopes in the sculptures of the famous temple



The Chinese, the Indians (North American and East), and the Egyptians have long used the lily as an article of food; it is now being introduced to Americans

Lilies Are Being Used for Food

WE are all familiar with water-lily culture for purposes of beauty; but growing lilies for food is a new idea in America, though it has been practised on a large scale for centuries in the Orient. Dr. L. H. Bammel, chairman of the Iowa Conservation Board, Mr. Melvin R. Gilmore, curator of the North Dakota Historical Museum, and other scientists lately have been making a study of the food value of the lotus-lily, the big yellow water-lily found in many lakes, ponds, and rivers in the Eastern and Middle Western United States. This lily was highly prized as a food by the

American Indians, just as its pink cousin, the lotus of China, India, and Egypt, is a favorite food there.

Peeled and boiled, the American water-lily is as farinaceous and wholesome as a potato and delicious to the taste. The aforementioned scientists are advocating the utilization of American waters for its cultivation for the purpose of adding to our dietary.

Propagation of the American lotus is not difficult, declare the scientists, and there are numerous ponds and lakes in nearly every State, whose waters are suited to the profitable culture of the lotus-lily.

Molding Marble for a New Parthenon

A NEW process whereby a synthetic stone, indistinguishable from the finest Parian marble, may be mixed and molded like concrete is being used to build an exact reproduction of the Parthenon of Athens. It was copied in brick and plaster as one of the temporary buildings to house the art collection of the Tennessee Centennial Exposition.

Nashville wished to make the building permanent, but the expense of marble made it out of the question.

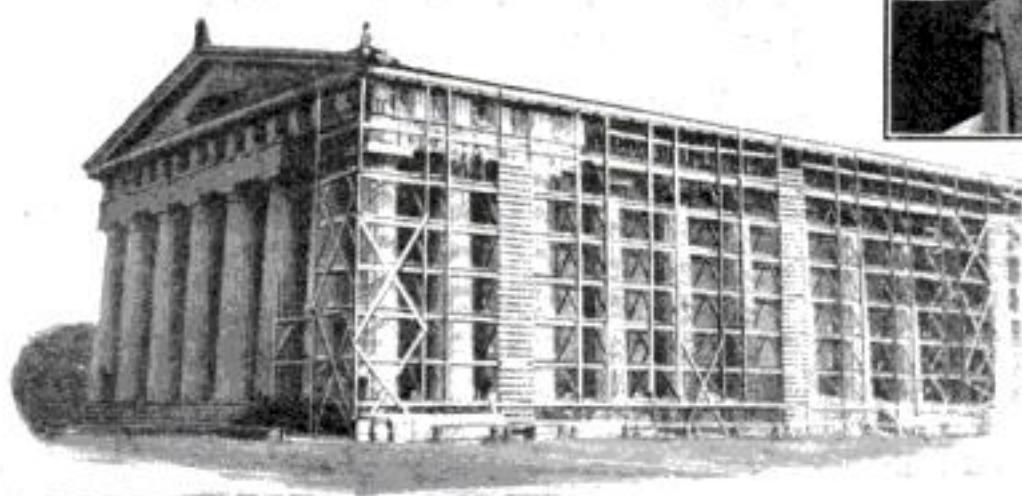
The situation was saved by George Julian Zolnay, a distinguished sculptor, who employed the magic of his studio laboratory to make marble without waiting for the slow deposit of tiny shells by microscopic crustaceans, and the conversion of this limestone into marble by volcanic action and the percolation of water which are required to produce the genuine Parian marble.

Zolnay's process is simpler, and the prod-

uct can hardly be distinguished from Nature's. To a combination of Portland cement and water a mixture of petrinite is added to produce the necessary calcium-carbonate crystals.

These combine with the calcium-silicate crystals formed by the Portland cement, and harden into a strong, waterproof rock with a white crystalline surface.

While the material is still liquid it is forced into molds which reproduce the carvings and pillars of the original Parthenon, and at a fraction of the expense.



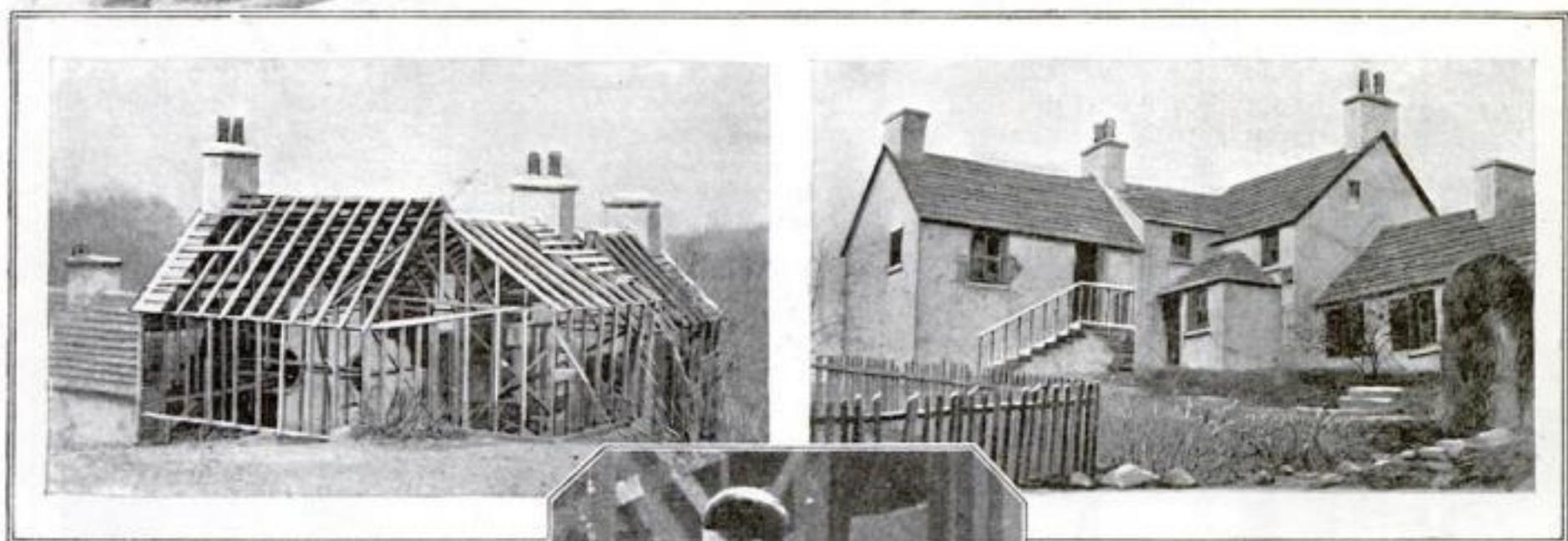
An exact replica of the Parthenon being reconstructed at Nashville, Tennessee. Synthetic stone is replacing the temporary plaster of the original model



Building a Scotch Village for the Moving - Pictures

16836

This is the Scotch village as it appeared on the screen, built of weatherbeaten stone. It is an exact reproduction of a real street, and people who knew Scotland believed the picture must have been photographed abroad.

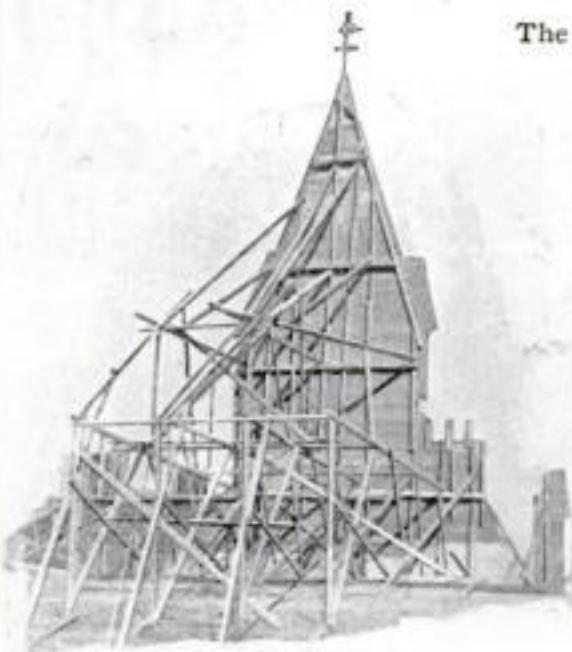


But the stones are papier-mâché and behind the scenes there is nothing but uncovered framework. This is how the house on the right looked from the rear. The scenery of the movies is no more real than that of the theater; it is built to be seen only from one side but nothing looks flimsy.

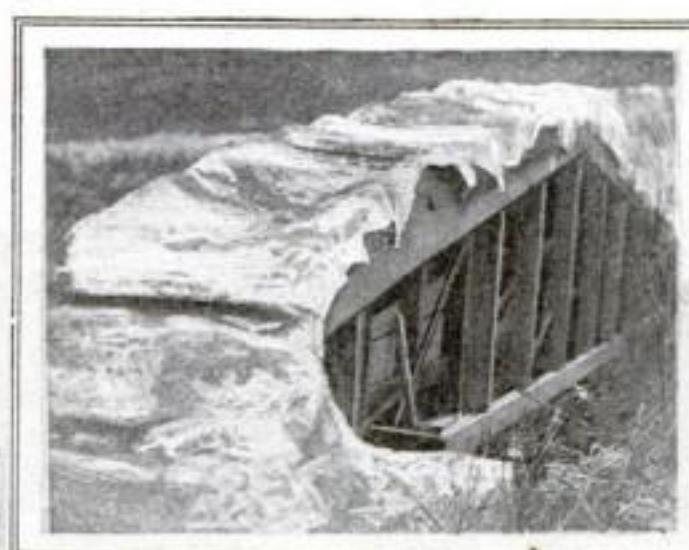


The interior scenes are taken in the studio, not on "location"

When the actors went inside for an indoor scene, you were sure the house was built in three dimensions, but the picture on the left tells the truth. The interior views were taken days later in "sets" built in the studios. The actor closing the door was a half mile from the place where he opened it.



This may look like a billboard, but it is really the back of the church shown on the right.



What seems to be stone is a plaster-and-staff composition smeared over a wooden form and carefully painted to simulate age. Do you recognize the wall in the first illustration?



Camouflage makes the flat surface shown on the left appear like the two sides of a church tower.

New and Useful Things for the Home

© Keystone View Company



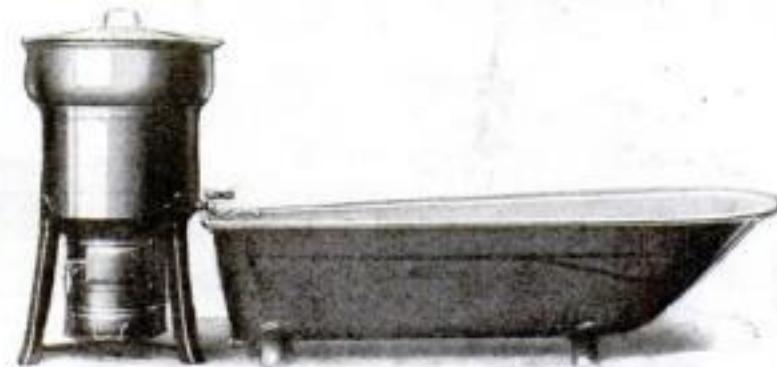
You press a button at the top when you wish the salt and pepper. A perforated cylinder inside emerges when the button is pressed, and the salt and pepper pour out through the holes.



When cabbage is cooked, the pipe shown above should be used. It is connected with the regular stovepipe and has a funnel at the other end that covers the pot and carries off the odor. The funnel can be swung around



Here is a hose-cart that eliminates the time-consuming job of holding the hose when spraying the lawn. You wheel it from place to place and then wind the hose around it when you are finished.



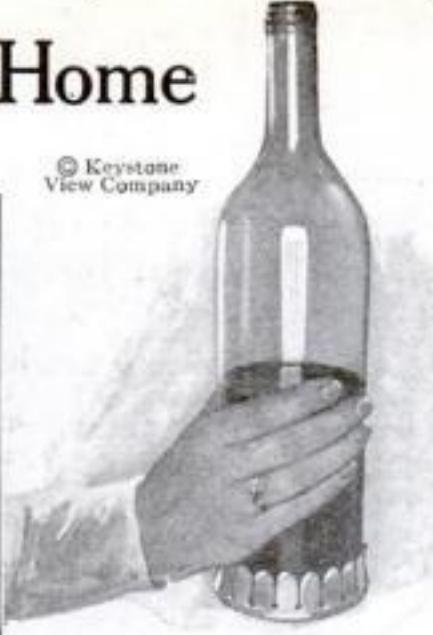
For houses in which there is no running water this combination tub and stove has been built. Water is heated in the large pot and the faucet is then turned on. The stove burns either coal or gas.



Here is a glass top that fits over a half lemon that is being squeezed. You hold it by the handle and twist it from side to side. The inside is corrugated to prevent slipping.



Electric-light fixtures attached to the piano are of great help to musicians; they throw light directly on the music, thus insuring improved playing.



For wine, beer, and ketchup bottles this holder has been invented. It fits around the bottom of the bottle and catches any drops that may run down



To all outward appearances this apron is like the aprons you usually buy, but a close inspection shows that this one is rubberized on the under side. This prevents stains from soaking through.



This can-opener flattens down the rough edges after it cuts through the lid of the can; the danger of cutting your hands on the jagged points of tin is thereby eliminated.

Keeping Up with the March of Science

Facts for the man who wants to know

Use of Fuel Oil for Power

THE use of oil as fuel for power by public utility plants should be restricted. It is essential for the operation of airplanes and automotive vehicles and has many advantages for marine use.

Since the supply is limited, it is important to conserve it for their highly important purposes, or even restrict its use to this field. In order to do so, of course, adequate power sources must be provided for the public utilities. This may be accomplished by a larger use of water power, which is taking place on a large scale in California, where hydroelectric stations are rapidly replacing oil-burning power plants.

White Plague Dying Out?

REPORTS from the National Tuberculosis Association show that consumption may soon become a rare disease in the United States. Public education in preventive measures and years of hard work by medical officers have checked its spread, and the death rate goes down steadily every year. This is in marked contrast to the tremendous increase of tuberculosis in Europe due to the ravages of the war.

Thyroxin Hastens Age

THYROXIN, which is the active secretion of the thyroid gland, has a marked effect in speeding up life processes.

With human beings, physicians are careful never to stimulate the activity of the thyroid beyond its normal activity, for experiments with the lower animals indicate that too much thyroxin produces quick maturity and may shorten the normal span of life. Tadpoles dosed with this secretion stop growing and turn into perfectly formed mature frogs almost at once. Some of these artificially aged frogs are no larger than a fly, much smaller than any existing in nature.

Tadpoles that have had their thyroids removed refuse to turn into frogs at all, but simply grow double and treble the normal length and weight.

Meteorological Observations

IN using balloons for the investigation of conditions existing in the upper strata of the atmosphere at sea, difficulty lies in the recovery of the apparatus. The Prince of Monaco has solved the problem by sending two balloons aloft in tandem, one of which is more fully inflated than the other.

Below the second balloon hangs the meteorograph and below that a float acts in conjunction with the balloon to keep the instruments above the surface of the water.

When the tandem balloons reach the required height, the more fully inflated balloon bursts, and the apparatus descends.

By charting the course of the ship that sends up the balloon and noting its altitude with a theodolite at the moment it bursts, it is possible to calculate its distance from the ship.

To know where the balloon will fall on the water, it is necessary to learn its altitude, the rate of fall, and the direction and speed of the winds at all levels traversed. The first two are known precisely, and the last is guessed at roughly by assuming the balloon will encounter the same air currents during its fall as on its rise.

Search is made for the balloon in the direction of the resultant line joining the starting and bursting points of the gas bags. The method is approximate, but the balloon floats three hundred yards above the surface and can be seen approximately seven miles, and few will be lost if the ship is able to steam fast enough to keep the balloon in sight until the time of the burst.

Lightning Does Strike Twice

FOREST experts have decided that while lightning may never strike twice in exactly the same place, it has a habit of striking in the same locality. It has its zones, where it usually appears in every electrical storm.

Lightning ranks next to sparks from locomotives and camp fires as a cause of forest fires, and by mapping the location of "lightning zones" and introducing special fire-prevention measures around these districts, fire loss will be measurably reduced.

From 1914 to 1918 lightning caused one forest fire in three, and in 1920 it ignited half the forest fires reported.

Non-Alcoholic Flavoring

ALCOHOLIC extracts have been used so largely for beverage purposes that it will be only a matter of time before the prohibition laws will prohibit their manufacture.

It took years of research before a substitute could be found to replace alcohol as a solvent, but non-alcoholic liquid flavors are now on the market.

The new solvent is not volatile, and there is no loss of the extract through evaporation.

Airplane Lays Telegraph

THE Army Air Service of Sweden reports that a six-mile section of telegraph cable was successfully laid by an airplane in eight minutes. Six of the eight minutes were spent in flight and the other two in making connections.

Chalk as a Coal Substitute

BY treating chalk with a patented process by which it is blended with a rich carbonaceous material a British company claims a fuel can be produced as efficient as coal for household use, at a price of \$3.75 a ton. The fuel has a valuable by-product in that the ash remaining after combustion can be utilized as cement or fertilizer.

Do Your Eyebrows Join?

THE old superstition that leads the stage villain to make up with eyebrows that meet over the bridge of his nose as a sign of his fiendish character has been given some color by recent developments in psychopathology.

Physicians have found that mental derangement is frequently accompanied by alterations in the appearance of the eyebrow, and that such variations tend toward the joining eyebrow of the villain of melodrama.

In maniac depressive cases the outer third of the eyebrow is often missing, while dementia praecox is marked by short bushy hairs which fill up the space over the nose.

Watch Liberty Motor

BY fitting a glass window in the cylinder of a Liberty motor the Bureau of Standards has been investigating the color and duration of the flame produced by the explosion that drives the piston.

The investigators have determined that the phenomenon known as "fuel knock" is accompanied by an exceedingly bright flash of very short duration, and is caused by the fact that the explosion of the mixture is practically a detonation.

Slight changes in the mixture produce marked differences in the color of the explosion flame, and the apparatus gives more accurate knowledge of the proper mixture ratios for any given grade of gasoline than is possible by auditory or brake-resistance tests.

Oil Kills Many Birds

HEAVY oils are used for fuel in the place of coal by many sea-going ships, and so many are the advantages of this fuel that even some of the older ships that heretofore used coal have been adapted to oil firing.

The change of fuel has led to unforeseen and disastrous effects on aquatic birds and inhabitants of the sea that, like oysters, are firmly attached to the sea bottom in comparatively shallow shore waters, or, like clams and numerous crustaceans, live in closely circumscribed areas of the tide-washed beaches.

The attention of the British government

has been called to the fact that, since the introduction of oil firing, many thousands of dead penguins, guillemots, gulls, and other birds have been washed up on the Yorkshire coast.

An examination showed that the plumage of the birds had become so heavily coated with the oil covering the surface of the water that they could neither fly nor dive. It is also reported that the oil is rapidly destroying millions of oysters, clams, and crustaceans along the British coast, thus seriously threatening the future of the shellfish industry.

How great is the danger from this source may be inferred from the result of experiments undertaken by the late Lord Rayleigh in 1889, which proved that 500,000 tons of oil would suffice to cover the entire sea surface of the earth with a thin film.

The House Redolent

FIFTH AVENUE shops display a variety of electric perfumers that are used to give rooms the delicate fragrance of a flower-garden. The perfume is placed in a glass container and vaporized by the heat of a concealed electric light.

The perfumers look like artistic metal wall ornaments. It is claimed they will scent the living-room with rose, the dining-room with violet, and the reception hall with lily of the valley at the desire of the owner.

Temperature of Planets

PLANETS without atmosphere are freezing cold in the shade and boiling hot in the sun. By the use of an improved bolometer Professor Véry has demonstrated that rocks in the equatorial region of the practically airless moon attain a temperature of 356° F.—144 degrees above the boiling-point—at the lunar midday.

The highest temperature was not reached until a day and a half after the sun had passed its highest altitude, showing that in spite of the large amount of radiation due to the lack of an atmosphere, the heat continued to accumulate, although the sun was declining. In the late afternoon it was discovered that the heat fell off rapidly.

Minnows and Yellow Fever

AN incipient epidemic of yellow fever at Tampico was arrested by placing top minnows (*Gambusia*) in the ponds and cisterns. At the outbreak of the disease six hundred men were kept constantly employed putting crude oil on the ponds and marshes, and the use of oil on the cisterns and barrels containing rain-water, which is the only source of water supply for the Mexican population, caused serious dissatisfaction.

It was found that a few minnows in each water container would eradicate the mosquito larvae. The fish have entirely replaced crude oil as a yellow-fever preventive, the natives are highly pleased at the change, and the reduction in expense amounts to three thousand dollars a week.

Reading in Bed

ONE may read in bed without excessive eye-strain if care is taken to have good light and to sit up so that you look down at the print.

Reading in a prone position is usually tiresome because we look up at the type. The eye is used so much to look at objects held below its level that the muscles which turn the eyes up have become weak from lack of use and become, therefore, easily tired.

Air-Compressor Explosions

EXPLOSIONS in air compressors are not likely to be due to ignition of oil vapor, since any oil present is lodged against the sides of the cylinder walls and is cooled by the proximity of the water jacket. Oil on the face of the piston might give off a little vapor which might ignite if the flash-point of the oil is lower than the temperature of air in the cylinder, but it is important to remember that the air is cooled during the

Things You Want to Know

Described in Popular Science for October

The Secret of Babe Ruth's Home Runs—How scientific tests have solved baseball's greatest mystery

Have Sunspots Put Our Weather Out of Kilter? Successful Talking Movies at Last!

A Chemist in Your Business Will Save Money Playing with Death at Niagara Falls

Typewriting by Wireless

"Vacuum Cleaners" to Unload Coal

And 300 other fascinating features that no live-wire man should miss

large part of the cycle, being heated only when the end of the compression stroke is reached.

Explosions are more liable to be caused by the presence of solid matter in the form of dust.

This dust may be derived from the carbonization of oil, or be introduced directly into the machine when the intake is near a coal-pile or where it can suck in smoke.

Oils that break down with a large percentage of carbon under the influence of heat and pressure are not suitable for use in compressors.

Alcohol from Seaweed

THE fact that seaweed thrown up on ocean beaches has been altered in the course of time to a substance resembling india rubber, and which contains 25 per cent of oily matter, affords fair presumptive evidence that natural oil—assuming it is of organic origin—has been produced by the decomposition of aquatic material.

Seaweed is available in unlimited quantities, and there is very little commercial use for it at present. Chemists believe that by the use of a suitable ferment it

could be used in the production of a cheaper alcohol than is possible with the use of foodstuffs and molasses as a raw material.

Giving Ether a New Way

EVER since ether fumes were first used in surgery for producing anesthesia, efforts were made to improve the originally crude methods of administering the pain-relieving drug.

In the past twenty-five years considerable progress was made in perfecting the technique of anesthetizing, but the principle of administering the ether through the lungs was the method generally adhered to.

During the recent war it became necessary to perform surgical operations on many individuals to whom ether could not be administered in the customary way because of severe injuries to the head. Some other method had to be found for such cases. After considerable research, Dr. J. T. Gwathmey, of New York, a member of the medical staff of the American Expeditionary Forces, developed a method of administering ether in the form of a mixture with edible oils, in which ether is soluble.

The ether, dissolved in vegetable or mineral oil, was given to the patients either by mouth or injected directly into the lower bowels. It was conclusively proved that ether evaporates from various oils suitable for internal use at a definite rate at the temperature of the human body.

More than 30,000 operations have been performed in which the ether was given by Dr. Gwathmey's method, and it was found that vomiting, nausea, and other unfavorable after effects were reduced to a minimum or obviated entirely.

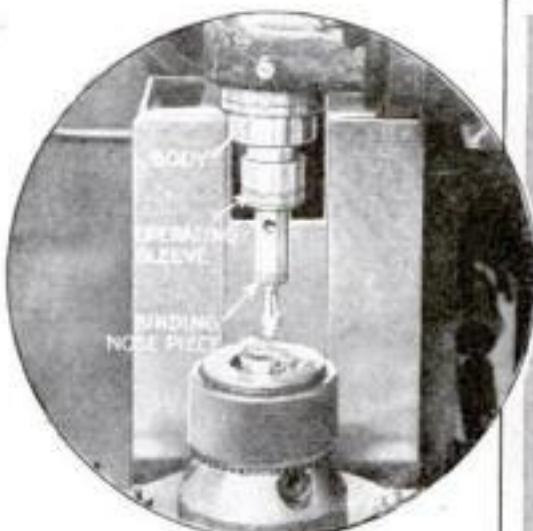
How Electric Shocks Kill

CAREFUL investigations by A. Finsler, a noted German scientist, confirm the theory that an electric shock, if sufficiently powerful, may cause death by paralyzing the muscles of the heart. A current of about 0.1 ampere, passing through the muscles of the heart, may kill a person in normal health. The voltage necessary to produce this effect depends on the resistance, hence mainly upon conditions of contact. If the contact surfaces are sufficiently large and moist, even 110 volts may cause a fatal shock.

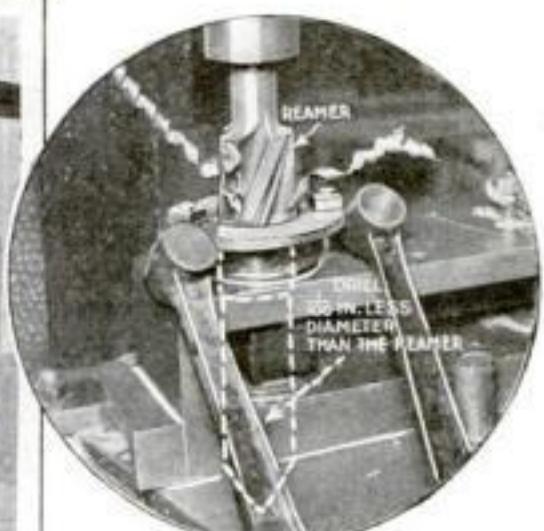
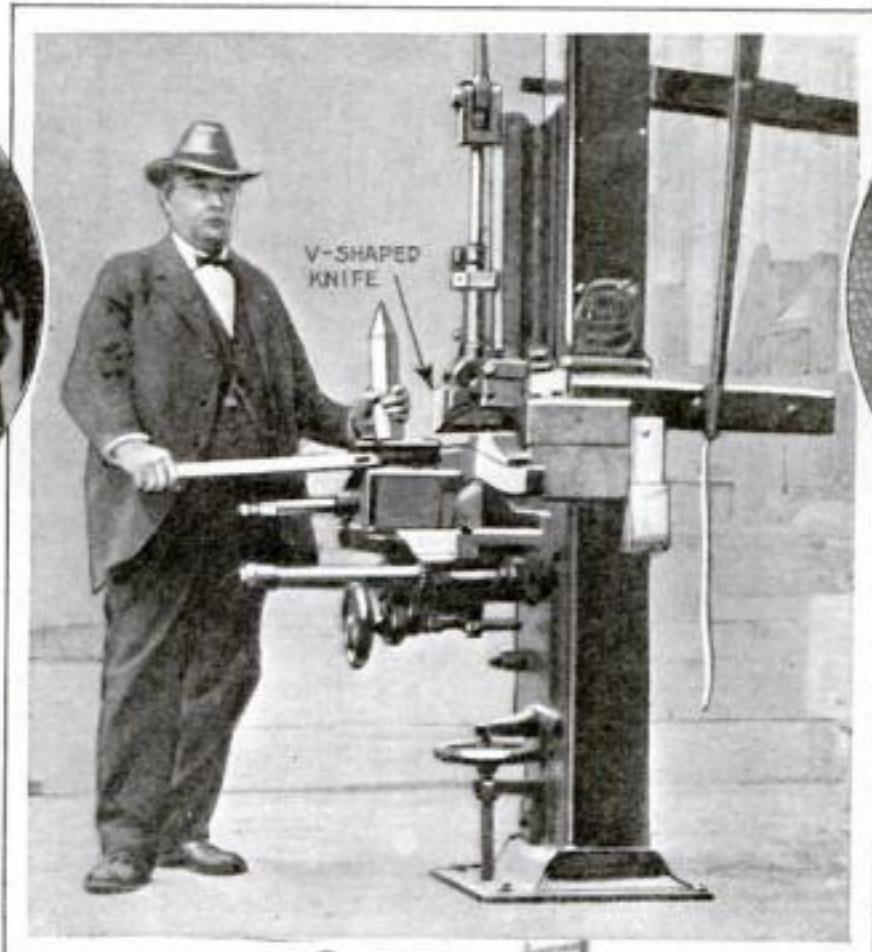
The danger is greatest when the heart is in the direct line of the flow of the current. The effect of alternating current at the usual commercial frequency, 40 to 50, is more severe than that of direct current. But at high frequencies, 4000 to 8000, the nerves cease to react, and such alternating currents are therefore not dangerous.

Serious burns are more frequently caused by direct than by alternating current. Experience in cases of legal electrocution has shown that a person expecting a shock will resist shocks that would undoubtedly kill him if he were not prepared. The proper treatment in cases of electric shock consists of an endeavor to restore the suspended action of the heart by artificial respiration.

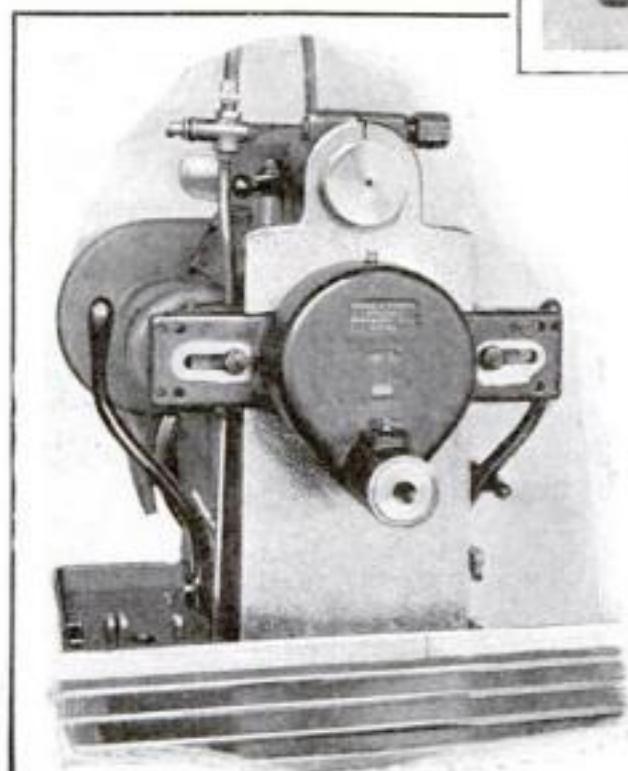
Tools and Machines that Save Time and Money



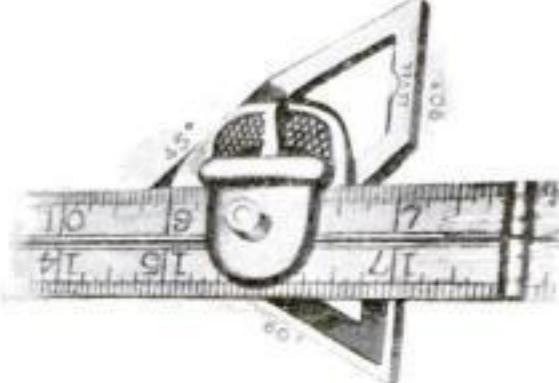
11404
This new chuck has a special positive grip that holds rigid without加紧 the stock. The chuck may be attached to any type of lathe without special devices



11406
Forty per cent increase in production is claimed for this tool, which will drill and ream in one operation. The reamer enters a bushing before the drill engages



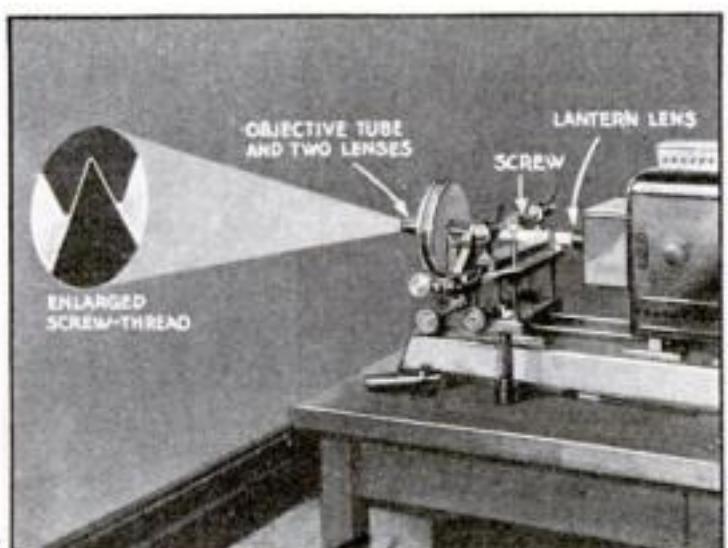
11407
A high-speed milling attachment has horizontal and vertical locating surfaces that give large bearing surfaces and make the attachment invaluable



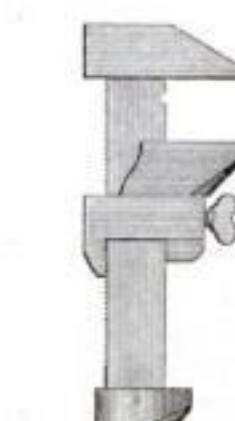
11408
With this pocket attachment a rule becomes a T-square, mitre square, center-square, depth and scratch gage, and a bevel. It is instantly adjustable to any of these forms



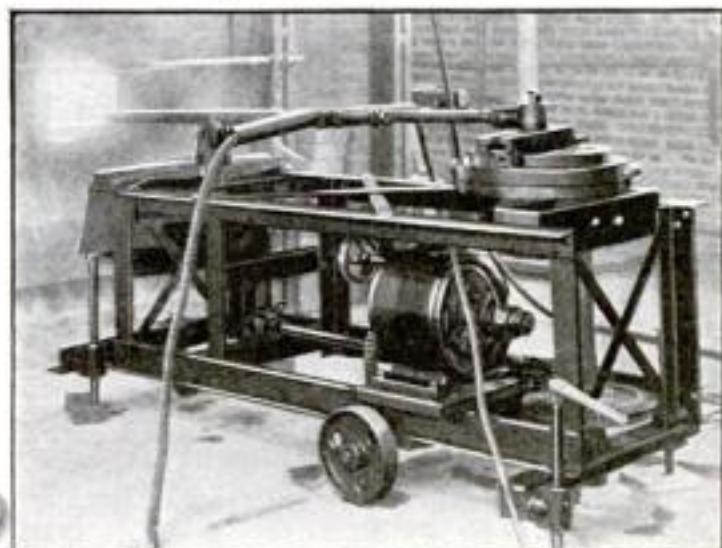
11409
Direct dial readings are given by this machine, used for determining hardness. A ball penetrator permits tests on small cubes without a mandrel



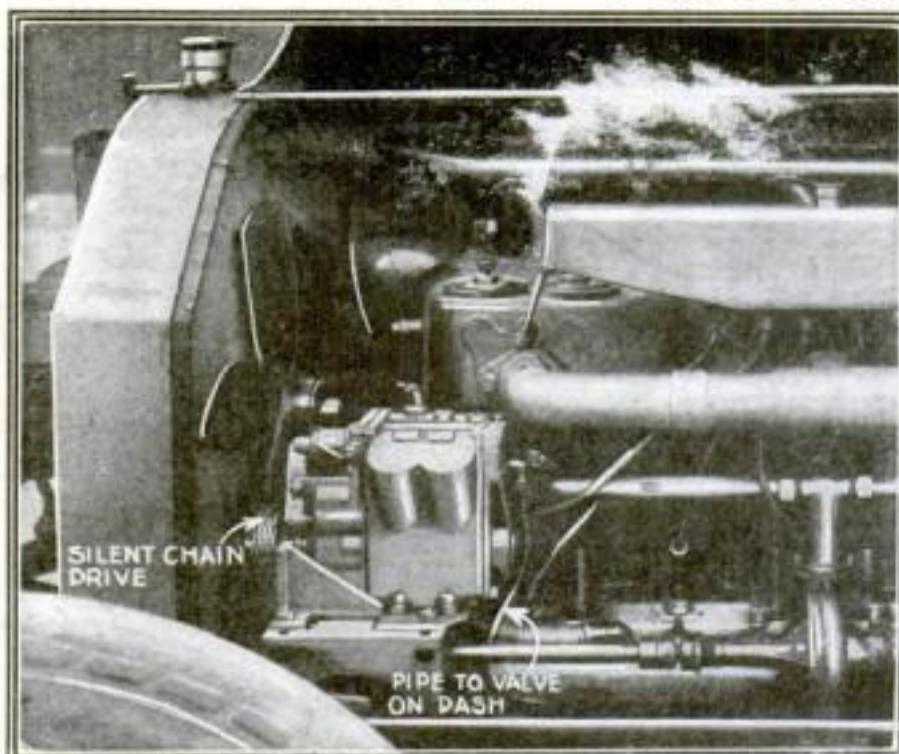
11406
For inspecting screw-threads this projection lantern magnifies 250 diameters, making every measurement apparent; it was designed by the Bureau of Standards



11403
One tool for a wrench, hammer, rule, and screwdriver. The transverse teeth on the shank make adjustments firm and positive



11400
In an automatic stirrer for molten optical glass the hose carries circulating water for cooling the stirring rod as shown in the picture above



Air-starter installed, taking power from the flywheel.
For inexpensive cars air is more reliable than electricity

Air-Starter for Small Cars

COMPRESSED-AIR starters have many advantages not possessed by the electric equipment and is not subject to easy disarrangement. When the electric equipment is employed, trouble with the system occurs very often, this being the case especially when the starting, lighting, and ignition systems all draw their current from the same battery. Too many of the lower-priced cars are not fitted with batteries of ample capacity to take care of the heavy current consumption in starting, especially when the automobile is used in service where the stops are frequent.

On the other hand, the air-starter is a self-contained unit with no connection with the lighting or ignition system. Trouble may be experienced with either system without in any way affecting the starting apparatus.

The air-starter illustrated is an adaptation of those used on airplane motors. It is characterized by its smallness and weight in consideration of the power it develops. The design is a four-cylinder unit in V form, compounded from two high-pressure cylinders to two low-pressure cylinders of larger diameter on the opposite side of the V.

The starter is connected with the crankshaft at engine speed either directly, by gear, or, best of all, by a silent chain-driver, and when the car is in operation it will compress air in the storage-tank up to three hundred pounds pressure. This is enough for fifteen starts, and may also be used to inflate tires and to clean the engine.

The piping and valve control is very simple. There are only two tubes, one leading from the reservoir-tank to the control valve, and an extension from the valve to the starter. The first tube is the only one that holds air when the starter is idle. The apparatus in its threefold capacity is controlled from the dashboard.

Concealed Identification Record

THE cleverest thief will fail to efface this identification mark. Small tubes containing a complete record of ownership are inserted in two of the car's chassis bolts, which are bored to receive them. The aperture is closed by slotted countersunk threaded pins, and their location concealed with paint.

The location of these two bolts is indelibly stamped on two important parts of the car, preferably in a conspicuous place, so that a policeman standing fifteen feet from the radiator will be able to learn at a glance whether the car is equipped with this means of identification.

The code will be known only to the owner and the insurance company protecting the car against theft, and it will be impossible for the mechanics to remember the location of the code bolts on the car.



Hide your ownership record in a chassis bolt such as this, to be found by a secret code.



The individual tubes give an increased radiating surface which prevent overheating

Improved Radiator for Converted Truck

WHEN a Ford passenger-car is converted into a ton truck, the slower speeds and heavier loads make a quicker and more ample radiation necessary to keep the engine cool. Moreover, with solid tires on the rear wheels the vibration sometimes causes the tanks to leak.

These difficulties may be overcome by installing a special motor-truck type of radiator with cast-metal tanks top and bottom and an individual tube type of core.

Henry Himself Wouldn't Know This Ford

IN the great game of disguising the flivver the grand prize is won by the originator of the motor body depicted below. It looks like an airplane, but—take it from Mr. M. D. Stewart of San Francisco—it is a Ford at heart.

The flivver—ardon, the fuselage—will hold two persons. The rudder moves from right to left as the steering-wheel is turned, and the elevator rises when the emergency brake is applied.

The radiator is fitted with a regulation laminated propeller which may be connected with the pulley on the fan belt or allowed to revolve by the air pressure created by the car's motion. The car is fitted with a starter and electric light on each side. The vehicle differs from an airplane only in the simple detail of being unable to fly.



If the owner makes this flivver go fast enough, he may feel as if he were flying

Trouble Wagon for Heavy Cars

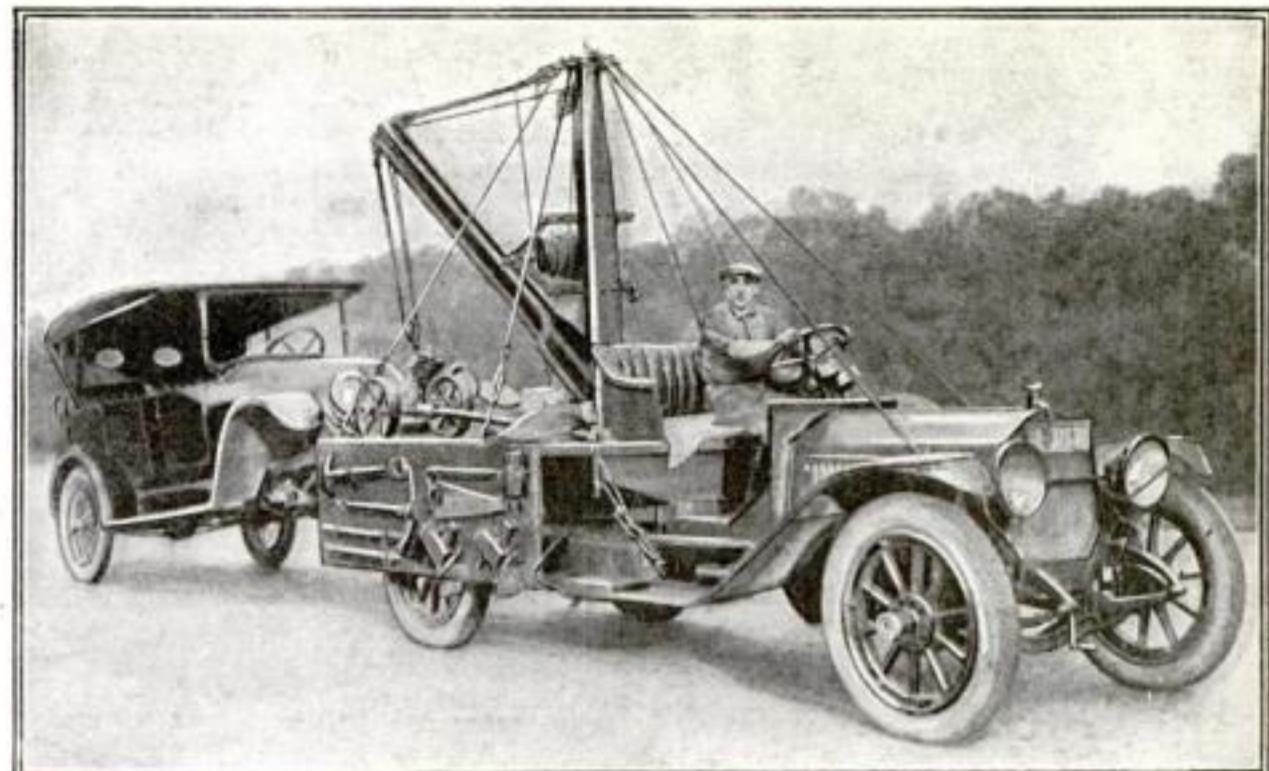
HARRY SINGLE, a garageman of Cincinnati, makes a specialty of towing badly damaged cars back to their shops for repairs, and the difficulties he experienced in handling a series of unusually bad wrecks convinced him that the ordinary wrecking equipment was too light to take care of the worst automobile accidents.

He designed the car illustrated at the right to overcome the limitations of the standard service truck. The special body is mounted on an old truck chassis. The crane is strong enough to pull a 4500-pound car up a 300-foot embankment, one of the jobs Single was called on to do.

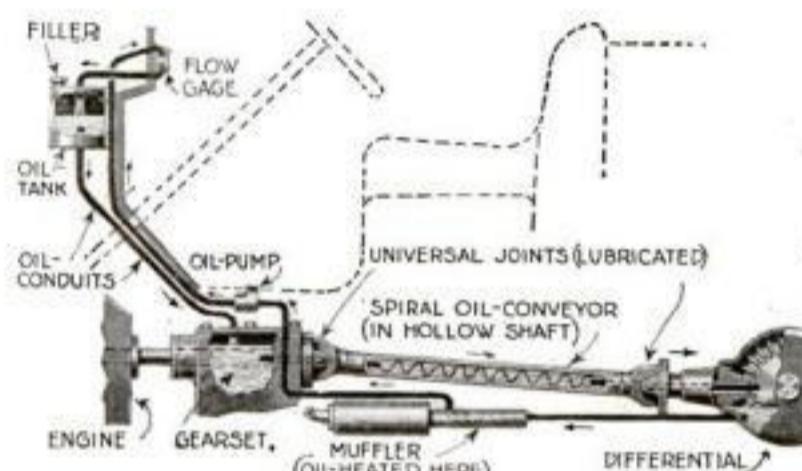
The sides of the car are hinged, and may be raised to form a bed twice the width of the truck.

No matter how badly smashed a car may be, the crane will pick it up and place it on this platform, and it becomes an easy matter to haul it away.

If the rear wheels are in running order, the front axle is rested in the U-iron pinioned on the rear step. The tools are mounted on boards, as shown, so that they may be found more quickly. When the job is done a glance at the boards will tell if any tool is being left behind.



Designed to pull heavy cars from the deepest ditches, this crane will pick a truck up bodily, place it on the rear platform, and haul it to the garage



This force-feed automatically and continuously oils the gear-box, U-joint, and differentials from one opening at the dash-tank

Force-Feed Oiling

THE system pictured at the left gives the transmission and chassis the benefits of force-feed oiling and permits the use of heavy oil without waste or danger of clogging the pipes.

Aside from the convenience of the system, which does away with crawling under the chassis periodically to fill grease-cups, the oiling is positive in operation.

The oil level can be adjusted to the proper height for each make of car. As there is a reserve of oil in each unit, there is no danger of the gears burning out through forgetfulness or failure of the supply system.

Brakes on All Four Wheels Prevent Skidding

ENGINEERS have demonstrated that the greatest load of a moving automobile is on the rear axle, but that the moment brakes are applied this load shifts forward to the front axle. This sudden change of the center of momentum tends to cause skidding, particularly if the car is moving over slippery pavement.

By applying braking force with equal tension to all four wheels at the same time, the danger of skidding is greatly lessened, and tests show that an eight-cylinder car with front and rear brakes traveling thirty miles an hour over a wet pavement can be brought to a stop in half the space required by a similar car having only rear brakes.

The brake construction recently invented by a resident of New Bedford, Massachusetts, named Landry, is comparatively simple. The front wheels are equipped with brakes of the same type

and size as those installed in the rear. The drums may either be bolted to the inside of the front wheels or welded to the hub flange, depending on the make of the car.

From the brake-bands a flexible cable leads to the foot-brake pedal. This cable passes through an S-shaped lever along a groove around its outer length, which is installed in order that pressure on the brake pedal will be

equalized for all four brakes. There are two S-levers, one on each side of the car, attached to a cross-rod bolted to the frame. The rear brakes remain as connected by brake-rods, except that they are attached to the S-lever instead of directly to the foot pedal.

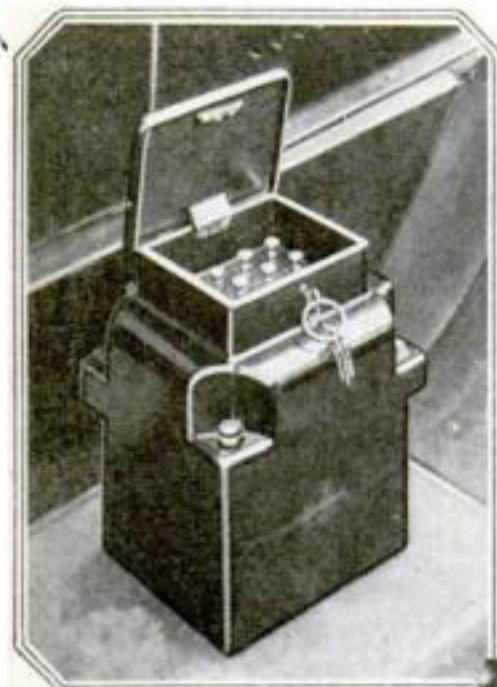
In reality, the only additional construction required in fitting on the new brake is the attachment of the brakes to the front axle. The S-lever is easy

to mount, since it is only necessary to bolt the tie-rod connecting the two levers to the frame, and the connection of the rear brake to the levers employs the brake-rods already on the car.

The flexible cable is necessary on the front brakes because, in steering, the front wheels are turned out of line with the rear ones. European racing-cars have been equipped with brakes on each wheel for some years, but this is the first application to commercial vehicles.



A brake on each wheel will stop the car in half the space formerly required and eliminates skidding on wet pavements



An alarm lock prevents car theft by an enclosed electric howler which warns police when the lock is tampered with or the car moved

18261

Novel Accessories that Simplify Life for the Car-Owner

16990

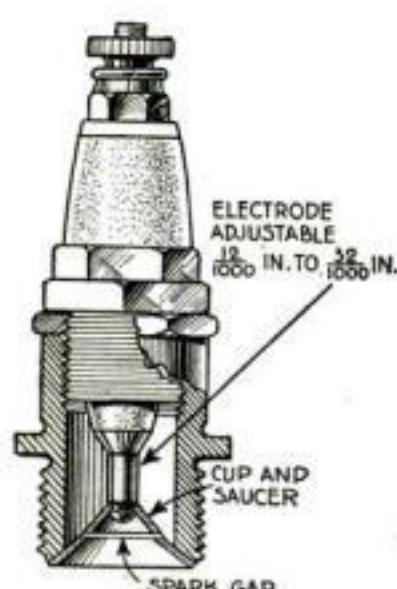


These wooden lugs attached to an extra rim provided by the makers prevent the tractor from sinking in the soft soil of irrigated rice-fields



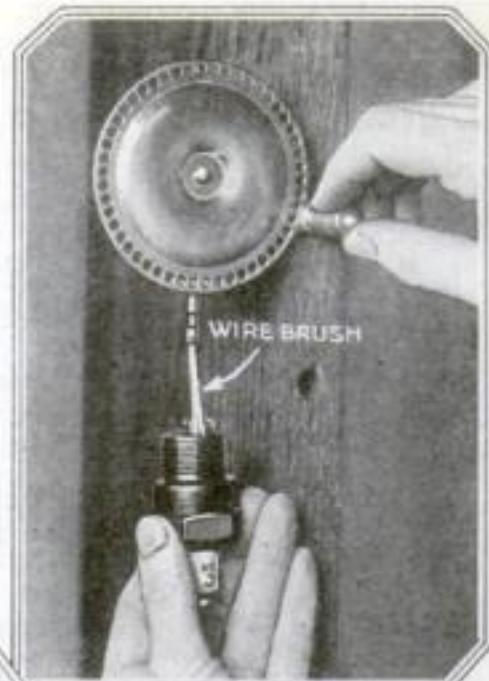
This motor toilet-set will appeal to road campers. It contains two gallons of water, soap, mirror, wash-bowl, comb, brushes, and towels

18399



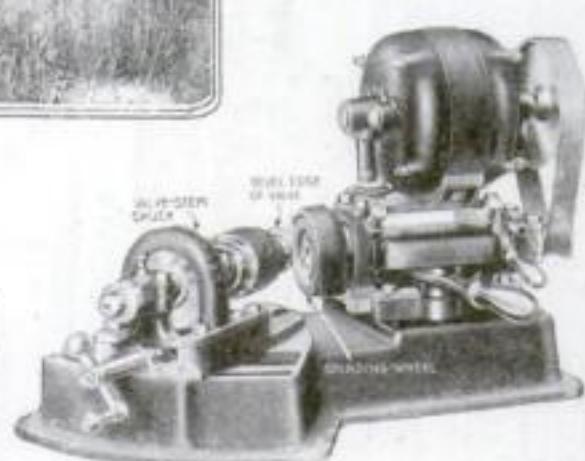
With this plug, carbon or oil fouling is impossible, as any foreign matter that touches the cup is blown away by explosion. The adjustable gap suits airplanes, trucks, or cars

16107



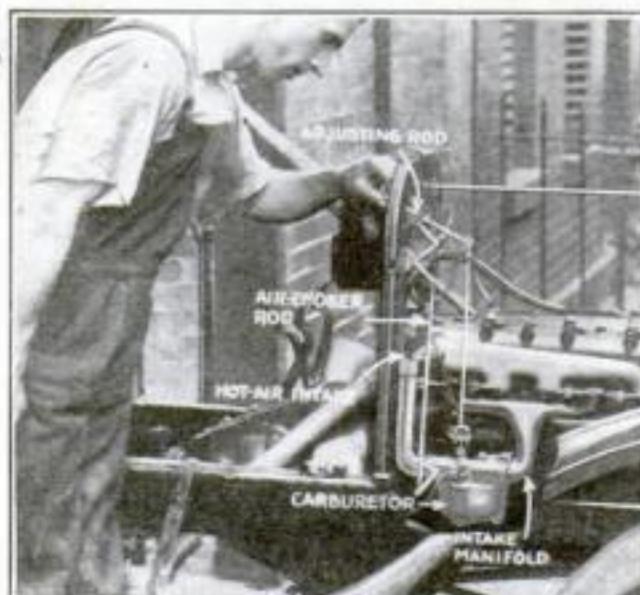
A few turns and the wire brush of this spark plug cleaner removes all foreign matter. Loosen the dirt by dipping the plug in gasoline

18033



The automatic grinder refaces one motor-valve a minute. A chuck insures centering on the valve-stem that works in the valve-guides

17449



Here is a needle-valve adjuster and choker device for Fords, fitted on the dashboard and provided with an adjustable dial for easy starting or extreme power

17612



These Tacoma buses have run 425,000 miles and are still in daily service

15349



As soon as the proper air pressure is reached in this safety valve for auto tires, further air is exhausted with hissing noise that warns the owner of over-inflation

When You Want Expert Advice About Your Car

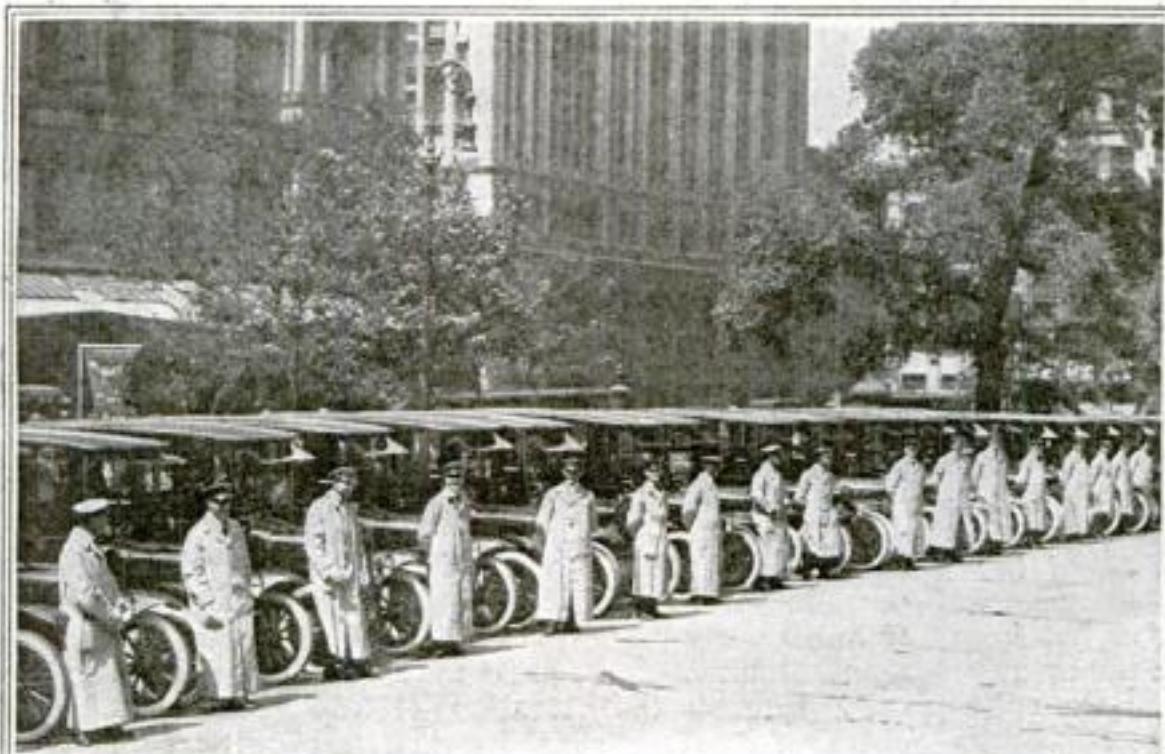
IN these pages of ideas about automobiles and motor-trucks the Popular Science Monthly endeavors to help its readers solve problems of maintenance and repair. But there must be special cases that are not cov-

ered, and we invite you to write to the Automobile Editor and let him advise you.

If you wish to know more about the devices pictured here, or if you want to ask questions, write. See answers on page 77.

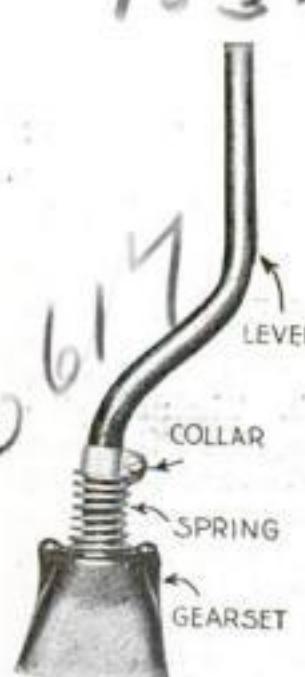


This radiator ornament is a busy aviator who handles his controls realistically. The propellers revolve when the car moves and a shaft geared to the little man keeps him moving
1313



A steel footboard for Fords fits snugly enough to stop all rattle, and is well finished, so that there are no rough edges to tear clothes
18347

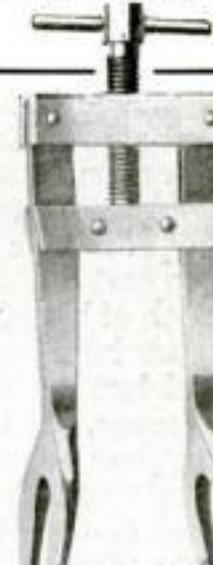
New York's city-owned taxi fleet lined up ready to carry municipal employees home from the City Hall
16291



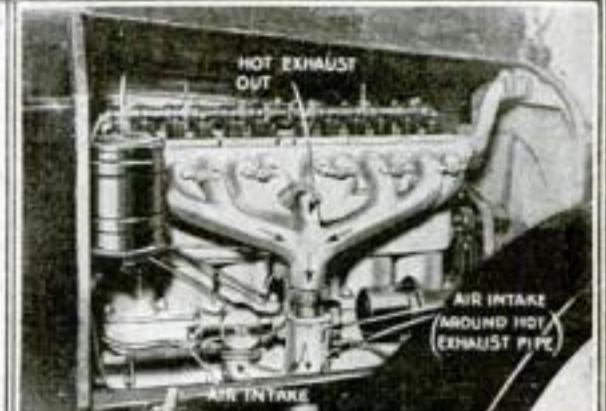
If the gear-shift lever rattles, it can be stopped by fitting on the simple coil-spring shown here
16611



Tractors and trailers for hauling ashes save thousands of dollars for the city of Indianapolis
17314



The design of the upper jaw of this sturdy valve-lift allows easy removal of the small parts on the valve-stem
17785



Hot exhaust gases from this engine surround the intake manifold and heat low grades of gasoline enough to secure perfect vaporization
14140



Here's a simplified battery-tester. Cadmium will attract only a negative current. When the rod is placed in battery solution, the light will not burn brightly unless the battery is fully charged
17884

Lubrication—the Life of the Motor-Truck

Poor lubrication costs ten times as much as the ordinary accident: here are some methods for overcoming it.

LUBRICATION is the very life of the motor-truck. Without adequate lubrication, disastrous results are sure to follow. Lubrication is the most important factor in motor-truck operation, for upon it depends the kind of service that the truck renders, the cost of that service, and even the length of life of the truck itself.

"Proper lubrication" should be the first and last commandment in every truck garage, for three fourths of all ordinary truck-repair work is due to inadequate lubrication. Accidents may cost hundreds of dollars, but inadequate lubrication may cost thousands.

No Truck Will Run without Oil

Engine pistons become so hot from lack of oil that they seize the cylinder walls, ruin themselves and the cylinders, and may even push connecting-rods down through the bottom of the crankcase. Bearings are burned out, and if the engine runs dry a worn clutch, gearset, universal joints, and rear axle result. In less than half a day the truck has depreciated as much as it would have in three or four years if given adequate lubrication.

Lubricating-oil is one of the cheapest supplies that enter into the cost of truck operation and maintenance, and yet it has perhaps the most important influence on satisfactory service.

We all know that some form of lubricant is necessary between two metal surfaces in contact with each other. The microscope tells us that even a shaft polished to the brightness of a mirror has a jagged surface of points that stick up like the teeth of a saw. Without some sort of lubricant between such a shaft and a bearing of equal smoothness, one can imagine how these minute saw-points would engage with one another and grind themselves into dust, resulting in looseness and still more wear. The lubricating-oil not only fills the depressions in the surfaces in contact, but interposes a film between them. This film may be only three one

By Joseph Brinker

thousandths of an inch thick, but it is sufficient.

Lubrication of the engine is effected with fluid oil, with slightly heavier oil for the other power-transmitting parts and grease for the chassis parts, except in one or two special systems where light oil is also used.

Adequate chassis lubrication is one of the big problems facing truck designers to-day. It has been partially solved by reservoir wick oilers in which a cotton wick leading from a reservoir of sufficient for a month lubricates the parts automatically through the vibration of the chassis. Another step forward has been made in the automatic pump lubrication system, in which the grease-cups are replaced by small metal pipes from one central pump reservoir which feeds oil under pressure to all of the chassis lubrication points.

Aside from mechanical disarrangement in the lubricating system, inadequate lubrication is due to carelessness or lack of responsibility for lubricant replenishment. In either case, the frailties of human nature require that some system be provided to place a check on every necessary lubricating operation.

In his efforts to secure adequate truck lubrication, the truck-owner must begin by impressing the importance of the matter on the driver. He must be told why lubrication is essential and how and when each part must be lubricated. If

the driver is held responsible only for the lubrication of the engine and the power-transmitting members, and the chassis greasing is left to a "lowly greaser," he too must be impressed with the importance of his work and the necessity for continuous care. This can be done by the truck superintendent by word of mouth and with the help of chart drawings, and instruction books that are gladly furnished free by nearly every truck manufacturer.

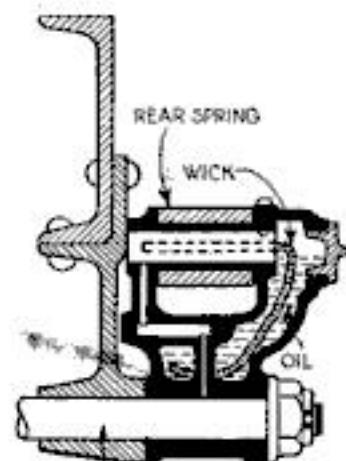
The directions for oiling, as contained in the truck manufacturers' instruction books, are very explicit and point out by name every part of the truck requiring oil, with definite statements giving the grade or kind of oil recommended, the amount needed, and how often the supply should be replenished or renewed.

How to Keep Lubrication in Mind

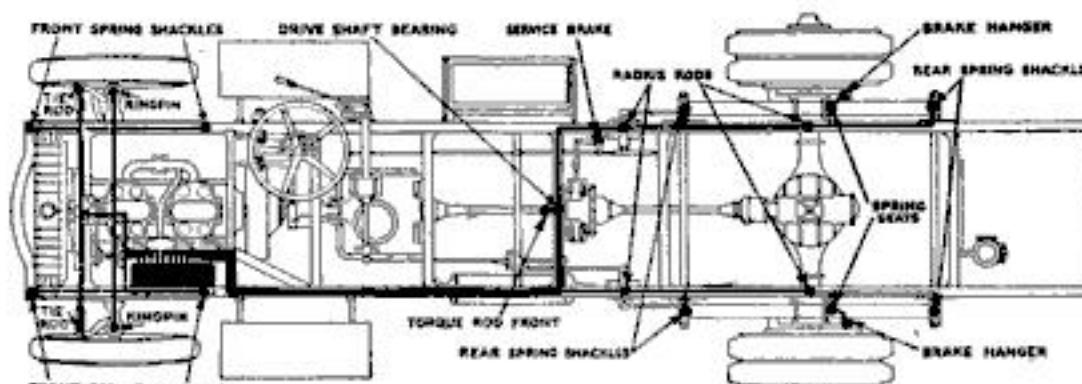
When the driver has been taught that the engine oil should be completely renewed after approximately every thousand miles of running; after the greaser has been taught that the rear axle housing should be refilled after about five thousand miles, and such and such grease-cups should be turned down every hundred to a thousand miles, the next step is to provide some means to keep the work always in the minds of those responsible for it and for checking their performance of such work.

One successful method of keeping the work continually in mind has been to tack up an oiling-chart on the garage wall. In that prominent position it can be readily seen at all times by the truck-drivers, mechanics, and all those responsible for any portion of the lubricating work. The next step is to chart the performance of the work in order that no detail of it may be overlooked. For convenience, the work may be divided into heads of engine lubrication—power-transmission parts lubrication, and chassis parts lubrication.

A chart or form



The reservoir holds a month's supply of oil, and the wick feeds it to the bolts as needed

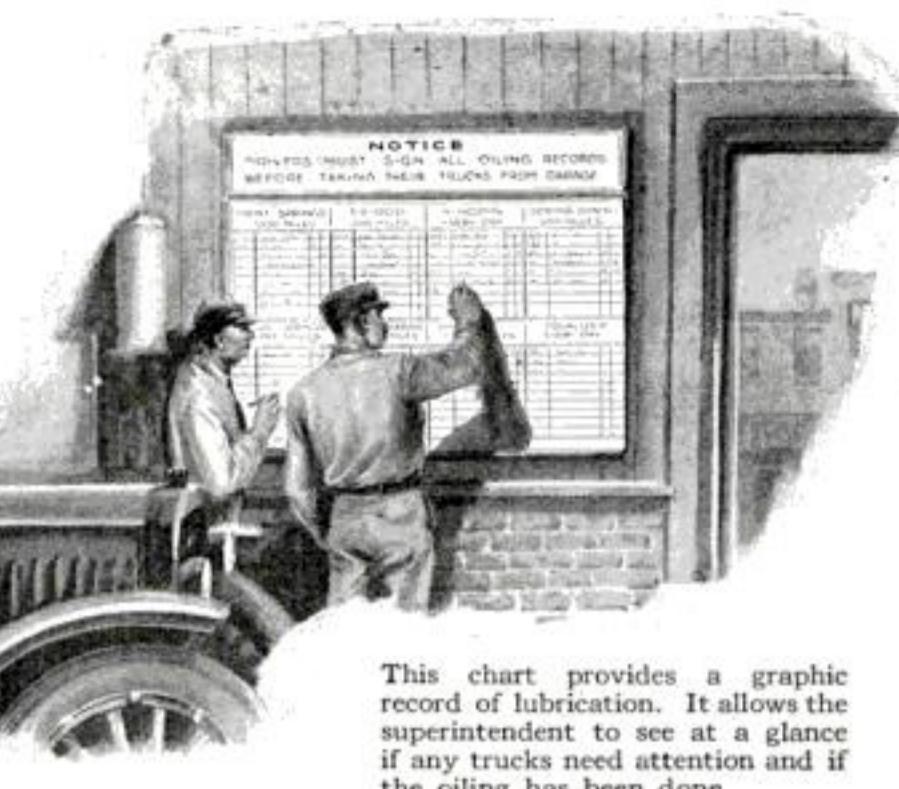


Good lubrication depends on constant care. The driver should be convinced of its necessity and made responsible for the oiling of his own truck. The superintendent posts this diagram in the garage for the instruction of the force

may be made for each truck, or one large chart for the entire fleet. Opposite each truck should be written notations as to the date at which all of the parts should be lubricated, and opposite these blank spaces in which the man responsible for either oiling or greasing may write the date on which the actual lubrication was done and sign his initials to prove it.

If one chart is too unwieldy on account of the size of the fleet, separate charts may be made for different phases of the work. For instance, one chart may be used to record engine lubrication, another for gearset lubrication, and still others for rear axles, wheel-hubs, universal joints, steering-gear, and all other chassis parts grouped under one head—Chassis Parts.

Such a chart or charts presents a graphic record of the lubrication work done, and permits the maintenance superintendents to determine at a glance which, if any, truck has not



This chart provides a graphic record of lubrication. It allows the superintendent to see at a glance if any trucks need attention and if the oiling has been done

received the attention that it should have been given. The charts may be large or small according to the desire of the maintenance manager, and may be kept in a book in his office or tacked up on the wall of the garage. One owner devised a large blackboard suitably ruled off in white paint, with spaces for the date of lubrication work to be written down in chalk. When such a chart or blackboard is placed on the garage wall, it serves as a reminder and a stimulator to action on the part of those responsible for the

other truck of the same make, size, and age, there must be something mechanically wrong with the engine that uses such an excessive amount of oil. When this fact is indicated by the chart, it at once suggests the necessity for an engine inspection, to determine whether the pistons are worn; whether there are excessive deposits of carbon, or whether there is a leak in the crank-case or some other part of the lubrication system that is running away with your profits and ruining your valuable truck.

Write to Us About Your Motor Troubles

If you have a motor-truck or automobile problem, let the Automobile Editor solve it

Alcohol as Fuel

Q.—Can I run my automobile on alcohol? I have plenty of potatoes, cottonwood, and straw. Please tell me how to make alcohol for mechanical use or where I can learn how.—G. J., Choteau, Mont.

A.—Alcohol is very expensive as a fuel, but can be used to run the average internal-combustion engine. Alcohol can be made from potatoes by a formula that you can secure from the United States Department of Agriculture, Washington, D. C., although it is our impression that it is now against the law for private individuals to manufacture alcohol.

This Engine Stops

Q.—My automobile engine stops ever so often and after a little while it will run again. What is the matter with it?—F. G., Kansas City, Kan.

A.—Dirt in the gasoline line or loose petcocks in the line (or imperfect working of the vacuum-tank, if one is fitted) may cause an engine to run and stop intermittently when otherwise apparently in good condition.

Engine Loses Power

Q.—The engine of my car does not seem to have much power, and one cylinder often misses when the engine is pulling, but standing still it runs fine.—M. S. T., Emporia, Neb.

A.—Worn commutator parts or worn piston-rings may cause an engine that does

not knock when idling to knock when put under a load. Worn piston-rings are the most common cause of poor engine compression. You probably need new piston-rings.

One-Piece Piston-Rings

Q.—Kindly inform me as to the manufacturing of a one-piece piston-ring, and state the different operations and the machines used.—B. O'N., New York City.

A.—The different operations and the machines used in the manufacture of a one-piece piston-ring are as follows: 1. Ring cast with special pattern to allow for spring. 2. After cleaning, ring bored or ground on the outside. 3. Ring faced on both sides to rough dimensions to allow for finish. 4. Ring rough turned, cut, and finished or ground on outside diameter. 5. Finished on sides by grinding on face grinder having magnetic chuck.

Loading Lumber Quickly

Q.—I am operating motor-trucks in the handling of lumber, and desire to obtain a device upon which a load of lumber may be prepared so that it may be loaded directly on the motor-truck when it returns from its previous delivery trip. Loading lumber by hand takes one hour. I want a device to load the same quantity of lumber in ten minutes.—E. U. F., Orofino, Idaho.

A.—Your problem may be solved by any one of three methods: 1. A portable stand with rollers at the same height as

those on the truck body. 2. A portable overhead framework, used with two differential hoists or chain-blocks. 3. A boom derrick or crane mounted on the motor-truck chassis and operated either by hand or by power from the engine through a gearset take-off.

Numbers as Theft Protectors

Q.—I am desirous of placing numbers or letters on certain parts of my automobile as identification marks in case of theft, and should like to know whether it is better to use metal punches or metal letters to cut through a film of varnish or wax and blow on an acid to cut the letters into the metal.—H. M. S., Los Angeles, Cal.

A.—The easiest and most convenient method of making identification marks on metal is to secure metal number or letter punches and transfer the numbers or letters by striking the punches with a hammer.

Using Castor Oil

Q.—Please advise me if castor oil straight or mixed with mineral oil is beneficial or deleterious for automobile engine lubrication.—A. A. S., Jr., Roanoke, Va.

A.—It is better to use castor oil mixed with mineral oil unless the engine is taken down frequently, as in airplane work. The use of castor oil alone tends to gum up the engine after from 250 to 300 miles of running.

lubrication work. Still other lubrication charts for recording the oil and grease consumption of each truck may be devised as a ready and reliable means of checking up on the condition of the truck, and particularly its engine. Such a chart, when properly read, may indicate symptoms of engine troubles before they actually occur.

It is apparent that if one truck uses twice as much oil as an-

Here Is a Good Jack for High Lifting

By G. A. Luers

THE usual car-jack lifts only to a height of about 10 in., making it necessary to use an overhead hoist for lifting in excess of this.

The jack shown in the attached sketch can be constructed to lift 3 ft. or even more.

For road-repair work or in the shop-yard this jack is especially useful and by means of it the front or rear end of a car can be



An easily constructed jack that will be of great service to the automobilist

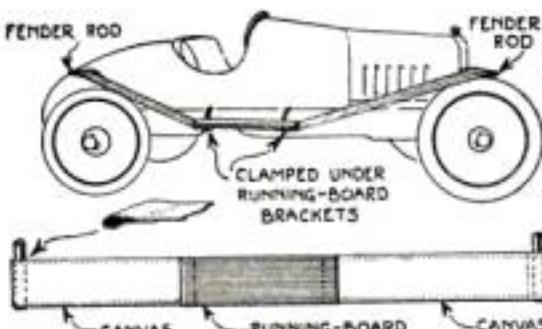
elevated 3 ft. or more and the wheels set on trestles or high supports while repairs are made underneath.

The construction of this special jack does not require any special machine work, and steel plate is used for the two main parts.

The base is made broad, 2 ft. by 2 ft., of

Some Canvas Mudguards for the Speedster

WHEN rebuilding a car into a speedster, the removal of unnecessary parts is desired on account of the reduction in the weight. Mudguards are removed because of this and the vibration that



During the rainy season canvas mudguards will add to the comfort of riding

ensues when riding at high speed. It is, however, desirable to provide guards for protection from dust and mud when the car is used for riding other than on the track.

Oiled canvas mudguards afford protection without adding to the weight or causing vibration. In the appended illustration the manner of attaching these to a Ford is shown. This method is applicable in a general way to other cars. On the car referred to, each fender is held by a single support from the side of the body or frame. Using these as supports for the upper end

plate $\frac{1}{2}$ in. thick, which permits its use on soft earth without tipping over.

The side members are of $\frac{1}{2}$ -in. plate, 8 in. wide, 7 ft. long, or more if required, doubled over at the top and riveted to the base at the bottom. Two rows of drilled holes are made through these side plates about 4 in. apart, with the positions of the holes in the opposite rows staggered.

A lifting-bar 6 ft. long of $\frac{3}{4}$ -in. plate tapered to a handle at one end, 3 in. wide at the opposite end, which is turned up and cut out on the lower edge to engage the pins as shown, is used similarly to a

jack handle. In operation, two $\frac{1}{2}$ -in. diameter pins, of the same size as the drilled holes through the uprights, are alternately placed under the bar.

The pin in the rear hole is placed first, the bar pried down until the forward pin can be inserted. The bar is tilted back and the pin inserted in the next hole above in the uprights.

This is continued until car is elevated as far as is required and the bar is locked by placing the pin in a rear hole above the bar.

This jack is comparatively light and makes a serviceable addition to the shop or service-car.

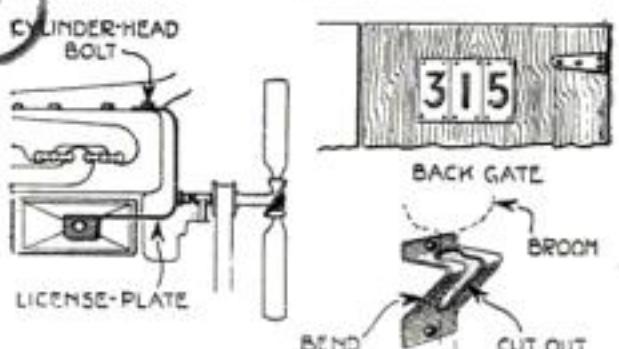
New Uses for Old License-Plates

AUTOMOBILE license-plates that are renewed annually have some usefulness. The enamel on them makes them rust-resisting and for that reason the numbers can be sheared off in strips, rearranged and placed on the rear gates of city homes as house numbers.

One motorist used a number-plate as a draft shield by bolting it on the forward side of the intake manifold to prevent the cold draft of the fan from cooling the manifold to the extent of interfering with the carburetion, while another made a holder bracket for the garage broom. Apart from these uses, the plates are suitable as patches for holes in the wooden garage-floor.

The ingenious motorist will be able to

think of many other uses for last year's license-plate. The plates are made of pressed steel of a very good quality.

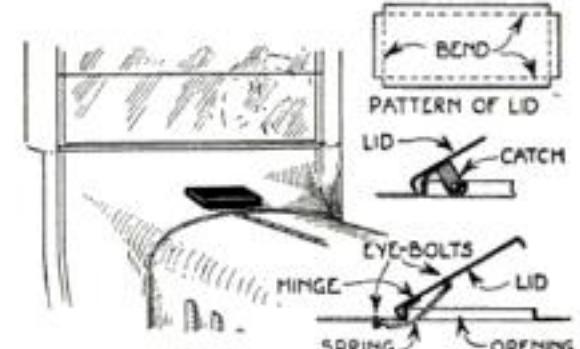


Three uses to which old license-plates may be applied

Ventilator Gives Access to Ignition Coils

FORD inclosed cars require the removal of the coil-box and the detaching of the wiring in order to remove the coils from the box to replace ignition points or for truing these up.

To avoid the work necessary to remove



Access to the coil-box is greatly facilitated by an opening provided in the cowl above the box

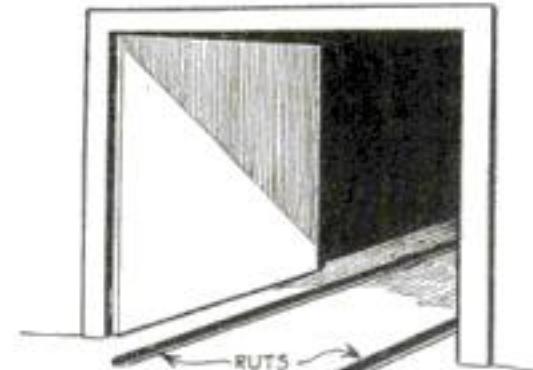
the coils, a rectangular opening in the cowl over the coil-box will permit of instantly taking out the coils from above. This opening can be closed with a hinged cover and makes an especially desirable feature for ventilating this compartment of the car in warm weather.

The illustration shows the details of the hinged cover, which is also useful for giving access to coils and ventilation on converted Ford speedsters using a low cowl extending rearward.—G. A. LUERS.

Ruts in the Garage Will Prevent Accidents

INEXPERIENCED automobilists are not always able to drive a car into the garage as straight as they would like to.

There is a remedy for this. In the mak-



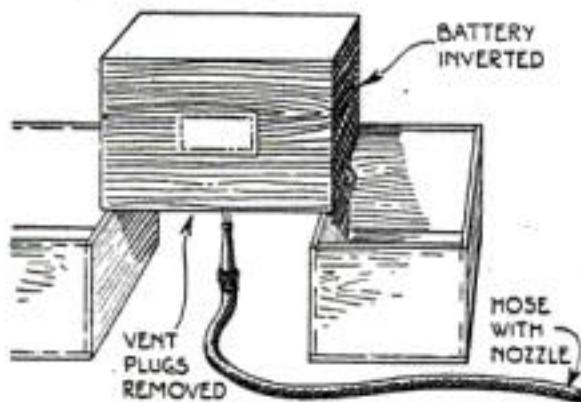
These ruts will prevent the automobile from being damaged by contact with the door-frame

ing of a garage, two ruts should be put in the floor. These will always keep the car straight, regardless of the experience of the driver.—G. BENDER.

Simple Treatment for the Storage Battery

AFTER a year of service, the storage battery will accumulate a sediment at the bottom of the plates that will result in a partial or complete inactivity.

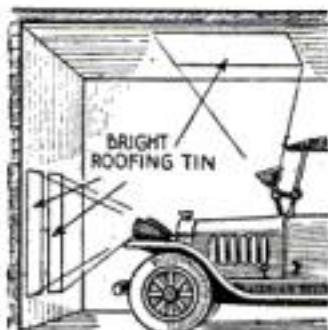
A simple treatment that will bring the battery back to near normal without



Showing how to keep the storage battery in a healthy condition

Illuminating the Garage for Night Work

SEVERAL pieces of bright sheet tin such as is used for roofing purposes can be used to advantage for illuminating the garage at night where no electric lights are installed other than those provided on the automobile.



By using sheet tin you can illuminate your garage effectively.

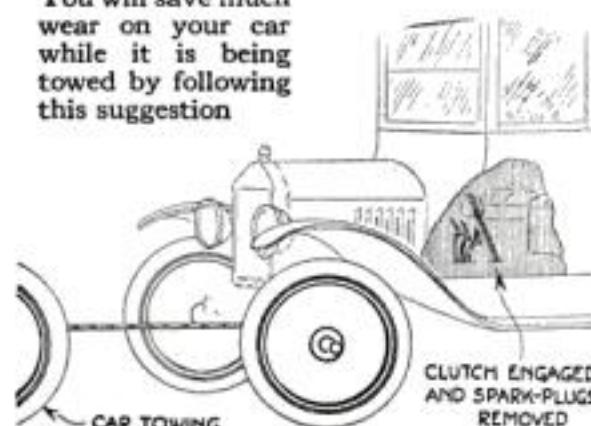
Place two pieces of the tin on the rear wall of the garage so that the headlights shine on them and another piece overhead or at the side, and focus the spotlight on this. An indirect reflected light will result that will enable the owner to make night repairs to his car when no opportunity is afforded during the day. This illumination will light the inside of the garage so that tools and equipment can be located.

Engage Clutch when Towing the Ford

WHEN trouble necessitates a Ford to be towed, the precaution should be taken to remove the spark-plugs and engage the clutch. The purpose of this is to prevent burning out the clutch disks.

With the clutch lever pulled back, the plates are only a few thousandths of an inch

You will save much wear on your car while it is being towed by following this suggestion



apart. When running, these tend to drag, causing them to heat and to gall.

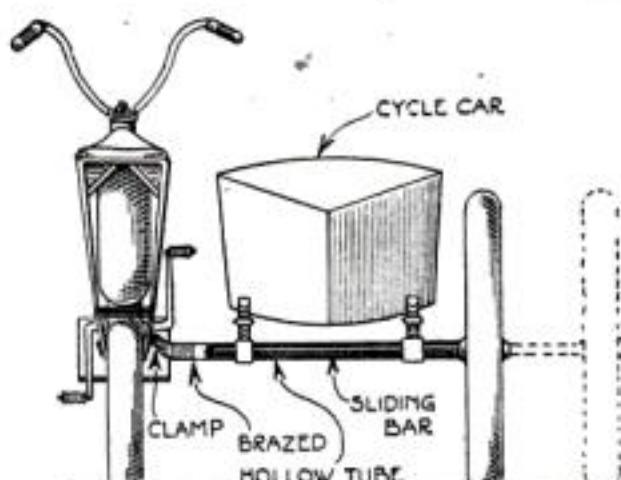
renewal of the plates is to empty the old electrolyte from the cells by inverting the battery. Support the inverted battery on two boxes or trestles, and with the vent plugs removed from the cells use the nozzle of the garden hose to direct a strong small stream of water upward and into all the spaces between the plates, to remove all evidence of sediment.

Leave the battery in this inverted position for several hours to drain out any remaining water. After this, fill each cell with fresh electrolyte, testing 1260 on the hydrometer. The battery should then be placed on the generator and brought to full charge, or until the hydrometer reading indicates 1360.—G. A. LUERS.

Supply Your Side-Car with an Extension Axle

BELOW is shown a simple method of providing a side-car with an extension axle.

A piece of tubing is attached to the body of the side-car and firmly connected with



Add to your riding comfort by placing this extension on your side-car axle

the frame of the motorcycle by a strong clamp.

In this piece of tubing is inserted another piece, to slide in and out. The end of the inner tubing forms the axle of the side-car wheel.

Two pins that pass through the outer tubing and fit into corresponding holes of the inner tubing hold the axle in whatever position is preferred for the axle at the desired gage.—JOSEPH F. SYLVIO.

A Homemade Lifting-Jack for Garage Use

VALUABLE for garage use is an operating lifting-jack. The accompanying illustration shows a type of jack that may be built from discarded automobile parts.

Two brackets such as are employed on the fan support are sweated to a rectangu-



A lifting-jack of this description is a great help around the home garage

lar steel plate. A shaft passes through these brackets as shown, while a pin prevents any side movement. A 3-in. hole is provided in the shaft, through which the lifting-bar is inserted when the jack is in use.—ADOLPH KLEIN.

Treat the Automobile Engine Hood Gently

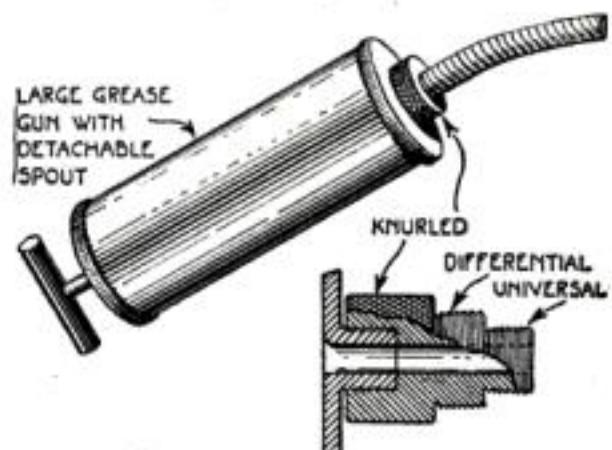
THE hood over the engine of the automobile rapidly loses its luster. Avoid as far as possible washing the hood while the engine underneath is warm. Varnish is the best method of restoring the hood to its former appearance and a desirable time to do this is when the engine is hot. Rub the hood down well with a handful of curled hair after washing thoroughly, and go over the hood with varnish and a good varnish brush. When the hood is heated, the varnish flows evenly and smoothly without the slightest evidences of brush marks and a thin coating can be applied to the heated surface which will dry rapidly and will not check as does a heavy coat.

Detachable Screw-Nipple for the Grease-Gun

LARGE grease-guns with detachable flexible spouts are made with the screw couplings of a size to fit the differential housings of a Ford. For other cars these are seldom obtainable. A detachable nipple coupling is readily added to the grease-gun which permits of screwing it into the filling-hole openings when putting grease into differentials, universals, or other grease-packed members of virtually any car.

When making up these nipples, instead of only one thread size to each detachable part, add two thread sizes, one for the differential and another for the universal. These screwed nipples simplify and expedite the work of putting in grease and by means of them a universal joint can be packed solidly, even when the opening is on the under side of the joint, as is sometimes the case.

Use brass bushing stock for them and knurl a section for unscrewing from the gun when required. This grease-gun will be found very satisfactory.



This screw-nipple will increase the usefulness of your grease-gun—try it



The Home Workshop

New and Useful Things for the Practical Man to Make

Construct This Ozone Water-Purifier Yourself

By L. A. Laurier

TH E ozone-gas water-purifier is absolutely reliable in its action and costs little to operate. The initial expenditure is small, as most of the work can be done in the home.

The first thing needed in the construction of this purifier is a high potential transformer. The amount of labor involved in making one of these transformers is so great that it is best to purchase one. The type used by the writer is inexpensive, requiring about 500 watts of alternating current when in operation. An ordinary $\frac{1}{2}$ kilowatt 9000-volt radio transformer was used. This can be purchased for about twenty-five dollars.

First, a box is built to house the transformer. This box is placed immediately above the shelf containing the ozone chamber. The leads from the secondary of the transformer are run through the bottom of the box through two tube insulators. The primary current comes through the top of the box. Two insulators should be placed in the top to accommodate these wires.

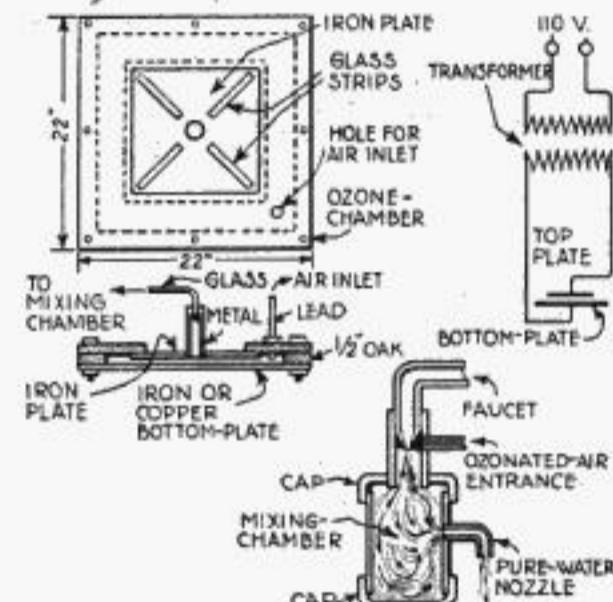
The ozone chamber is shown in one of the illustrations. First, a piece of $\frac{1}{2}$ -in. oak board is cut 22 in. square. Of course this does not have to be oak, but oak is best. A hole 11 in. square is cut out of the center of this wooden slab. A piece of sheet iron $\frac{1}{8}$ in. thick and 12 in. square is placed over the hole and held in place with small machine screws. It will be necessary to drill several holes around the edge of the iron plate to accommodate these screws. The nuts on the screws should be screwed up tight, so that a perfectly airtight joint will be produced. To assure this, it might be well to place a little shellac around the edge of the wood before the plate is put in place.

Four $\frac{1}{2}$ -in. strips of oak should be cut and bolted around the bottom edge of the square oak piece previously cut. Small stove-bolts can be used for this purpose and plenty of shellac and putty should be applied to make sure that all the joints are perfectly airtight. Before putting the bolts in place, however, four strips of window-glass $\frac{1}{4}$ in. wide and 5 in. long are placed on the iron plate that was previously bolted in place. These may be held in place temporarily with a few drops of shellac. Another iron plate 22 in. square is now cut and bolted to the bottom. The same bolts that held the oak strips in place are used, serving both purposes. Plenty of shellac should be applied to the wood before the bottom iron plate is put in place. After this is done, the entire outside of the chamber should be given a thorough coat of thick shellac.

A hole is now drilled in the center of the top iron plate and threaded to receive a small gas-pipe. A 5-in. length of pipe is

then cut and screwed into this hole. A hole for another air-inlet pipe is drilled in one corner as shown. A lead pipe is used in this case and before it is inserted in the wood it should be well smeared with shellac. It should be a tight fit.

The ozone chamber is now set on four glass insulators similar to those used on tele-



Details of the ozone and mixing chambers

graph-poles. These insulators are absolutely necessary. The lead air-inlet pipe previously put in place should now be inserted through a cork which fits into the mouth of a large bottle containing sulphuric acid. Another small lead pipe also passes through its cork and the end of this pipe extends down into the acid. The cork in the bottle should fit snugly and have melted paraffin poured over it. It must be perfectly airtight. It will be seen that if a partial vacuum is produced in the ozone chamber that air will be sucked into the chamber after first passing through the sulphuric acid in the bottle.

The mixing chamber is attached to the supply-water faucet. First, a piece of pipe is screwed to the faucet. A pointed nozzle should be either filed or attached to the faucet and this nozzle should run well down into the attached pipe with a space between it and the wall of the pipe. The small pipe that admits the ozone must be put in place as shown in the picture. Water rapidly passing from the faucet into

the mixing chamber will pull air with it and tend to create a partial vacuum in the ozone chamber. When a partial vacuum is produced here, air rushes through the sulphuric acid and tends to bring the pressure back to normal in the ozone chamber.

The mixing chamber can be made of a small length of fairly large pipe (about 3 in. in diameter) provided with two caps. The top cap is drilled to receive a small length of pipe that was previously attached to the faucet. A small length of bent pipe is also screwed into the mixing chamber to serve as a spigot.

The mixer is now connected with the small pipe in the center of the ozone chamber. Small gas-pipe should be used. The joints should be made tight as the successful operation depends largely upon this.

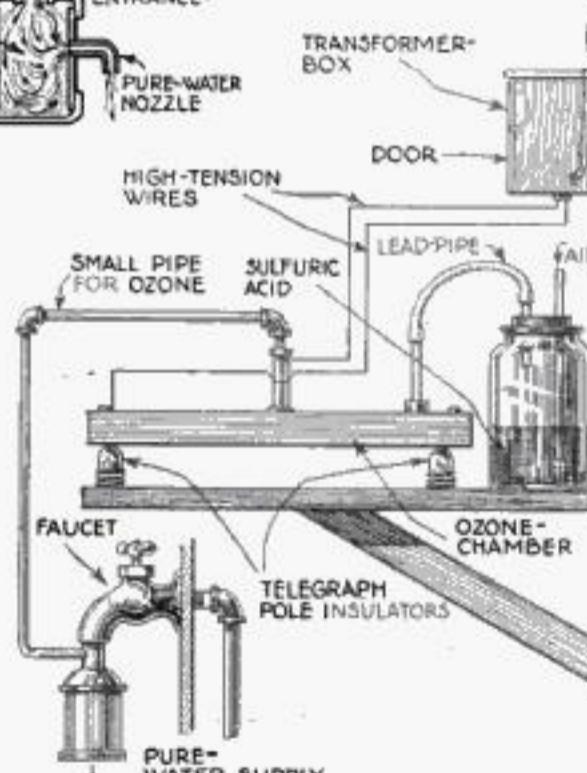
The ozone-generator and water-purifier is now ready to be put in operation. When the primary circuit of the transformer is closed, a large spark will jump across the air gap caused by the separation of the two iron plates. The passage of an electric spark through air always generates ozone. This spark will continue to pass as long as the circuit is kept closed.

Of course, the transformer must be connected with the iron plates by two heavily insulated wires. One wire is connected with one of the iron bolts that holds the bottom plate in place and the other with the center pipe through which the generated ozone passes.

When the water is turned on, a steady flow of dry air through the ozone chamber will result. As the dry air passes through, it comes in contact with the electric spark and part of its oxygen is converted into ozone. This passes with the rest of the air through the small pipe to the mixing chamber, where it is mixed with water and passes through the spigot.

It is during this mixing process that the dangerous bacteria are destroyed.

The transformer is operated only while the apparatus is in actual use.



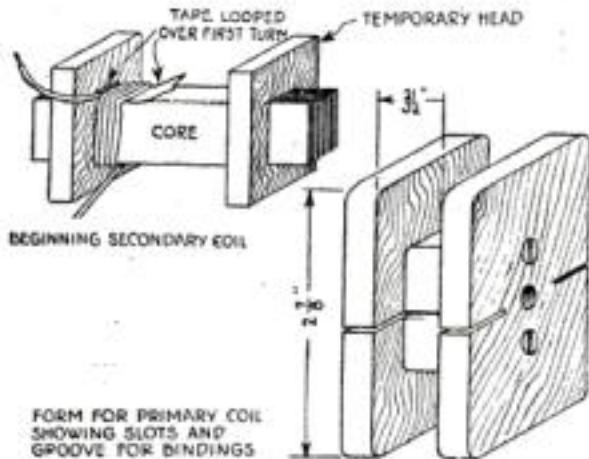
The general plan of the ozone water-purifying plant

Equip Your House with a Bell-Ringing Transformer

By H. H. Parker

THREE are two secondaries to this transformer, each giving about four volts, and while one coil will be sufficient for a single bell located reasonably near the transformer, the two coils in parallel will furnish twice the amount of current, suitable for a large-sized bell or any other signal.

If the bell or push-button is placed at a great distance, a higher voltage would be needed, in which case the secondary coils would be connected in



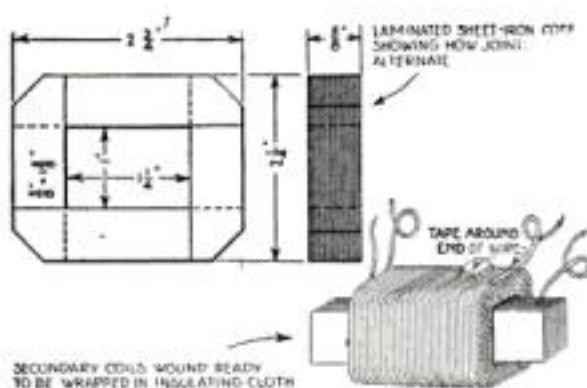
The winding forms used in the construction of the transformer

series, thus doubling the voltage. Or each coil could be connected with a separate bell and push-button, should such an arrangement be of advantage under the circumstances.

Regular transformer iron or silicon steel is used for the core. The iron is cut into two lengths, $2\frac{1}{8}$ in. and $1\frac{1}{8}$ in. respectively, all being $\frac{5}{8}$ in. wide. The corners are trimmed principally for the sake of appearance.

These sheets will form a rectangular core $\frac{5}{8}$ in. thick when tightly pressed together, the joints alternating so as to decrease the magnetic resistance of the core.

To begin, some of the longer sheets are piled up, overlapping alternately $\frac{5}{8}$ in. at the ends, until the pile will be $\frac{5}{8}$ in. high when compressed and bound with friction tape, leaving each end clear for $\frac{5}{8}$ in., so that the short yoke pieces may be inserted



This illustrates the assembly of the transformer core and the method of holding the wires in place at the end of the winding

after the coils are wound. A single layer of empire cloth is wrapped around this core and then three layers of No. 20 d.c.e. copper magnet wire wound on, with 35 turns to the layer, and keeping the length of the coil within $1\frac{1}{2}$ in.

In beginning this secondary winding, a strip of tape is doubled over the wire and the succeeding turns wound over the ends, thus securing the inner end of the coil.

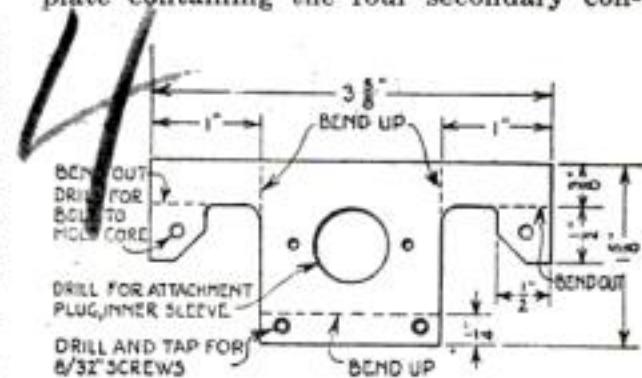
The outside end is also held in a loop of tape that is drawn through tightly when the last turn is put into place through the loop.

Next the coil is soaked in shellac and when dry, three more layers of No. 20 wire are wound on. To keep the end turns in place, a couple of temporary wooden heads may be fitted over the core and removed when the coil is complete; the shellac when dry will hold everything securely. Three layers of empire cloth are wrapped around the completed secondary coil and we are ready to start on the primary, or high-voltage, coil.

This winding is in two sections, wound on a separate wood form, then placed together, one section reversed and the two inner ends soldered together and the whole shellacked, taped, and slipped over the secondary coil. The wooden winding form has a core and two end plates about $2\frac{1}{8}$ in. square. The core must be large enough to allow for taping the coil and yet have the opening of such a size that the coil may be pressed on over the primary winding and core.

No. 34 d.c.e. copper wire is used for the primary with 1100 turns on each section, or a total of 2200 turns. Wind the wire on as evenly as possible, with a single wrapping of oiled paper between every two or

bolts which secure the core; the hole through the corners of the core should be larger than the bolts and the bolts wrapped in shellacked paper. The front edge of the plate is bent up and drilled and a fiber plate containing the four secondary coil-



The dimensions of the sheet-brass base plate which holds the transformer to the socket

binding posts screwed to it. Series or parallel or separate secondary connections may then be made at will.

Short lengths of flexible lamp-cord are soldered to the primary coil terminals before applying the tape, and when assembling, these are carried down into the attachment plug. Do not use black friction tape on this apparatus; plain cambric or "armature" tape, shellacked or varnished, or regular insulating tape, is suitable.

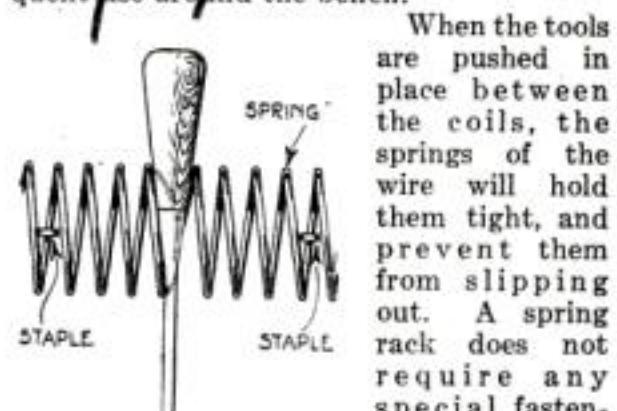
Protect Polished Table-Tops from Injury

MANY a polished table, stand, or other piece of furniture is ruined by water from flower-pots and vases. Such injury can be prevented by placing mats of linoleum, oilcloth, or, still better, of napped back leather substitute, of adequate size and cut in artistic form, under the flower-pots or vases.

These mats cost very little and will obviate many costly repairs.

This Spring Rack Is Handy for Tools

FROM a coiled steel or brass spring from 1 to 2 in. in diameter an excellent tool-rack may be made that will hold a large number of the smaller tools in frequent use around the bench.



Simplicity and usefulness are the keynote of this tool-rack

In a shop the spring may be fastened directly to the wall by a few staples. In the home, where it is not desirable to deface the walls, the spring should be nailed with staples to a board, which may then be hanged from screw hooks or otherwise fastened to the wall.—G. A. LUERS.

Instruments for the Home Electrical Laboratory

By Joseph B. Moran

INSTRUMENTS described in this article number among them some that are not so well known to experimenters and they may be constructed at small cost and without many tools. With these articles many entertaining and instructive experiments can be performed in the home laboratory.

The first instrument to be described will be one for demonstrating the rotation of a wire carrying a current around the pole of an electromagnet. This little apparatus is illustrated in Fig. 1, which also gives many of the details of construction. The dimensions are not important, as they can be made to work regardless of size.

The base of the instrument is about 3 in. in diameter. It is made round as a matter of appearance. A good hard wood should be used, as this will take a good polish when the instrument is finished. Four holes are drilled in the base. Two of these are made to hold binding-posts that may be taken from old dry batteries. One of the other holes is used to hold a 5/32-in. brass rod, which can be about 10 in. long. This rod is threaded with an 8/32-in. die at one end so that it can be held in the base with two 8/32-in. nuts. A binding-post is placed on the upper end of the rod and attached to this binding-post is a little hook to carry a long straight wire.

A small iron core, about 1/2 inch in diameter and 3 in. long, is now obtained. Two heavy cardboard washers are cut and forced over the ends of the core. The core is then wound with No. 24 magnet wire until the diameter of the resulting coil is about 1 inch. A little cup, as shown in the detail, is now made to fit over the end of the magnet. This cup may be produced from a piece of scrap material and drilled out to make a good snug fit over the end of the magnet, as the cup must be leak proof, owing to the fact that it is to hold mercury.

Demonstrating Electrical Principles

A piece of No. 22 copper magnet wire is now stripped of its insulation and rolled out straight under a board. This piece of wire should be just long enough to dip into the mercury in the cup over the magnet when it is hung on the hook carried by the binding-post by means of a little loop placed in the end.

One terminal of the magnet winding is connected with one of the binding-posts, the other end of the wire connected to the binding-post on the cup containing the mercury. The other binding-post is connected with the brass rod under the bottom of the base. Small grooves can be cut in the bottom of the base with a sharp knife for the connections underneath. The current passes into one binding-post up through the magnet into the mercury and then up the wire down the rod to the other binding-post. When a current is passing through the instrument, the wire hanging on the hook will rotate around the end of the magnet.

Figure 2 illustrates the law that states

that parallel wires carrying current in the same direction attract one another. A hard-wood base is first made and three holes are drilled in it. A fourth hole about 1/2 inch in diameter is drilled halfway through the base in the position shown. A brass rod about 1/8 in. in diameter is now bent at right angles as shown and fastened to the bottom of the base with nuts.

The other end is drilled out to serve as a binding-post, or a binding-post may be soldered to its end. Connection is made from this rod to one of the binding-posts. The other binding-post is put in place and a small wire is connected with it and bent so that it will dip into the mercury, which is placed in the 1/2-in. hole that was drilled halfway through the wood. A coil or helix of No. 28 bare copper wire is now made. This should be about 1/4 inch in diameter and the turns should be placed about 1/4 inch apart.

A source of current is connected with the two binding-posts. The current will flow into the pool of mercury, up through the coil of wire, down the posts and back through the other binding-post. When a current is flowing through in this manner, the turns of the coil will attract each other and the coil will contract. Hence the end of the wire dipping into the mercury will be lifted out and the circuit will be broken. When the circuit is broken the coil returns to its normal position only to jump back again when the contact is made between the mercury and the end of the wire.

The next instrument (Fig. 3) is known as a parallel current apparatus. A hard-wood base about the same size as that used on the contracting helix is made. Holes are bored in this, as illustrated, and two 5/32-in. brass rods about 10 inches long are placed upright in the two outside holes.

Both ends of these two rods are threaded with an 8/32-in. die and they are held in place by 8/32-in. nuts. A piece of hard rubber or fiber is cut and placed on the rods at the top as shown. Two holes are drilled in the fiber and tapped out with an 8/32-in. tap. A No. 29 drill should be used for this purpose. Nuts hold this piece to the rods. Two more holes should be drilled in this piece of insulating material and in these two little pieces of heavy wire bent at right angles should be placed. Little adjusting knobs are soldered to the opposite ends of these pieces so that they may be turned about. A binding-post is now inserted in the bottom and connection is made from this to

the little pool of mercury in the larger hole that was drilled halfway through the base. Two No. 28 copper wires are made perfectly straight and hung from the little angle pieces and allowed to dip into the mercury.

When the current is made to flow through these two copper wires in the same direction, the wires will attract each other.

When the current is reversed and made to flow in the opposite direction, the wires will tend to repel each other. Both the repulsion and the attraction are very noticeable.

A little reversing switch that can be made in the home shop is shown in Fig. 4. This little switch can not only be used with the instrument previously described, but it will also find many other uses about the experimenter's laboratory. A good hard-wood base is obtained and cut 4 inches square. Holes are drilled as illustrated to accommodate four binding-posts. These binding-posts will serve to hold down four little phosphor bronze contact strips that are to make connection with the little commutator device placed in the exact center of the base. The details of this commutator device are shown. A heavy fiber washer is first forced on a small shaft. This shaft is threaded at each end and passed through the base and is held in place by a nut that rests in a countersunk hole on the bottom of the base. Two semicircular pieces of brass or copper are cut and riveted to the fiber washer. After the rivets have been hammered in place, the surface is filed off flush so that the contact strips will not catch as the commutator is turned. A small knob is screwed to the central shaft to facilitate turning.

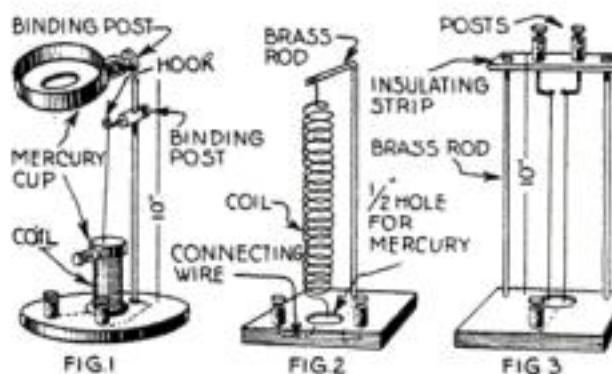
Figure 5 Illustrates Oersted's Law

An apparatus that is used to demonstrate Oersted's law, is shown in Fig. 5. First a 5/32-in. brass rod is bent to form an arch, and each of its ends is threaded with an 8/32-in. die so that the arch may be held to a hard-wood base with two small nuts. Two binding-posts are then placed on the base and connection is made from this to the two ends of the arch. These connections should be made underneath the base and grooves cut with a pocket-knife so that the connecting wires may be flush with the bottom. Before the bolts

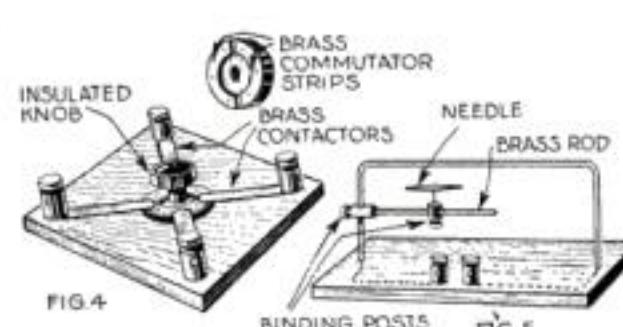
are put in place to hold the arch down, a binding-post is slipped on one side of the arch. Screwed into the end of this binding-post is a small length of 5/32-in. brass rod. Another binding-post is placed on this small length of rod and into the end of this binding-post a sewing-needle is placed. This needle is kept in place by solder. A

small compass-needle can now be cut from thin sheet iron. A punch mark is made in the exact center of this piece and it is caused to balance upon the needle-point.

When the current is caused to flow through the arch by connecting the binding-post to a couple of batteries, the magnetic needle will arrange itself according to the direction of the current.



Interesting experiments may be made by the amateur electrician with these instruments



No electrical laboratory is complete without at least one reversing switch as shown

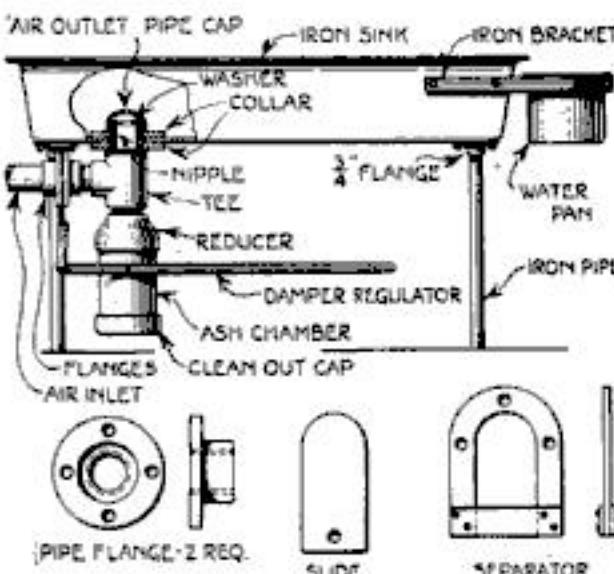
A Forge that Was Made of Pipe Fittings

A SUBSTANTIAL forge can be improvised out of an old iron sink and some pipe fittings. Four $\frac{3}{4}$ -in. flanges were bolted to the bottom corners of the sink and lengths of pipe screwed in for legs. A hole was made near one end, to admit a 2-in. pipe nipple. On the upper end of the nipple was placed a large washer of the same outside diameter and about a $\frac{3}{4}$ -in. hole, and a pipe cap drilled with a tapering hole and screwed on the nipple served as the blast-pipe.

A cast-iron collar was placed between cap and bottom of forge, and another underneath; then a 2-in. tee was screwed on, clamping the whole blast pipe assembly tightly together. Another nipple went into the bottom of the tee, then a 2- to 3-in. reducer, a 3-in. nipple about 6 in. long to serve as an ash and clinker collector, and finally a 3-in. cap. The whole chamber and passage could be quickly cleaned out by unscrewing the lower cap.

Next a 2-in. nipple was screwed into the open side of the tee and the two flanges forming the damper were attached. The damper construction was exceedingly simple. A U-shaped piece of sheet iron was bolted between the flanges, and a slide or damper made of slightly thinner material was slid between the arms of the U. Two cross pieces were riveted to the projecting arms to guide the damper.

A regulating lever was pivoted to the side of the ash chamber and connected by a short link with the damper. The whole



From an old iron sink and some pipe-fittings a serviceable forge suitable for farm or shop may be constructed

worked stiffly enough to allow the damper to stay in any position to which the lever was moved. For a hand-operated forge this damper would be unnecessary. The air-inlet pipe was screwed into the outer flange and was connected with an electric blower.

To the end of the forge opposite the blast-pipe, two iron straps were riveted to support a galvanized water-pan, a great convenience, if not a necessity, around a small forge of this kind.

A high-speed electric motor of about 1/6 horsepower, direct-connected with a fan-blower, furnishes the most convenient means of obtaining the air blast; or if there is machinery near, a small blower may be belted up to the shafting or driven from a specially rigged up countershaft.

Lacking any power, the blast must be furnished by hand, and about the simplest way is to attach a bench hand-power grinding-stand to the forge by iron brackets. The grinding-wheel is removed and a

Popular Science Is Offering Monthly Prizes for the Best New Ideas Sent to the Home Workshop Department

You have a chance to win the \$50 or \$25 prize

SEVENTY-FIVE dollars will be awarded every month to the authors of the two best articles appearing in this department. The first prize is \$50, the second \$25. Every article submitted will be considered as a possible prize-winner. Those which do not win prizes may be purchased at space rates. The prizes will be awarded upon publication, and the check will be mailed to the winner the same month.

The prize-winning articles may be long—but not over 1000 words—or they may be very short. The idea, device, or machine described must be practical and ingenious: it must fill an actual need in the home, office, or shop.

This new feature must not be confused with the other prize contests which the Popular Science Monthly has conducted during the past and which it will continue to conduct in the future.

pulley fixed in its place, then a blower (which may be picked up second hand at a low price, or built up of sheet iron) is bolted at a convenient point and belted to the grinder pulley. As this arrangement gives two speed step-ups, one of them geared, the high speed essential to efficient blower operation may be obtained readily.

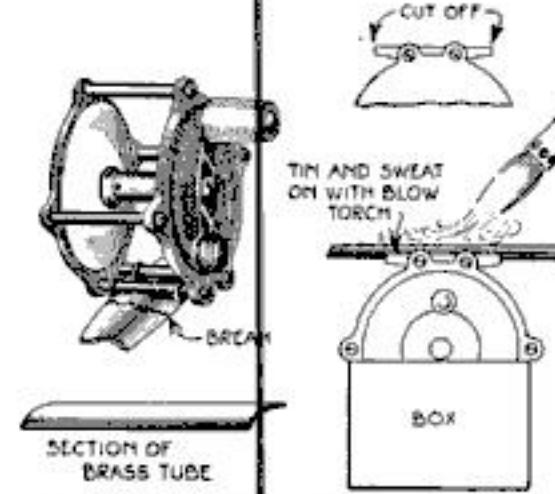
Any ashes or clinkers falling through the air outlet will fall to the bottom of the chamber and cannot stop up the blast-pipe until the chamber and reducer are completely filled.—H. H. PARKER.

For a Neat Repair of a Broken Reel-Seat

IN putting a new seat on a reel from which a part of the original seat had been broken, I proceeded as follows: I cut off both ends of the seat evenly, the remaining part filed bright, and tinned it with solder.

Then I cut a blank out of a piece of brass tubing and shaped it to match the old seat. This I tinned freely with solder.

Placing the reel in a tin box for a support,



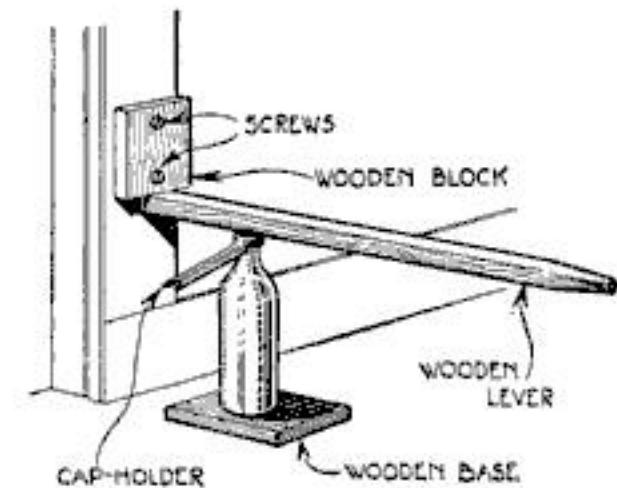
Nothing could be simpler than this method of repairing a broken reel-seat

I laid the brass blank on it, and sweated it on with a blowpipe. The weight of the blank pressed the thin coating of solder down evenly, so as to make a tight joint.

Employ a Discreet Silence When Capping Bottles

PUTTING metal caps on bottles with a capping machine or with a mallet makes a great deal of noise. This may be avoided by using the device illustrated here for capping.

A rectangular block of wood, 1 in. thick, 6 in. wide, and 8 in. long, is securely fastened to the frame of the kitchen door with



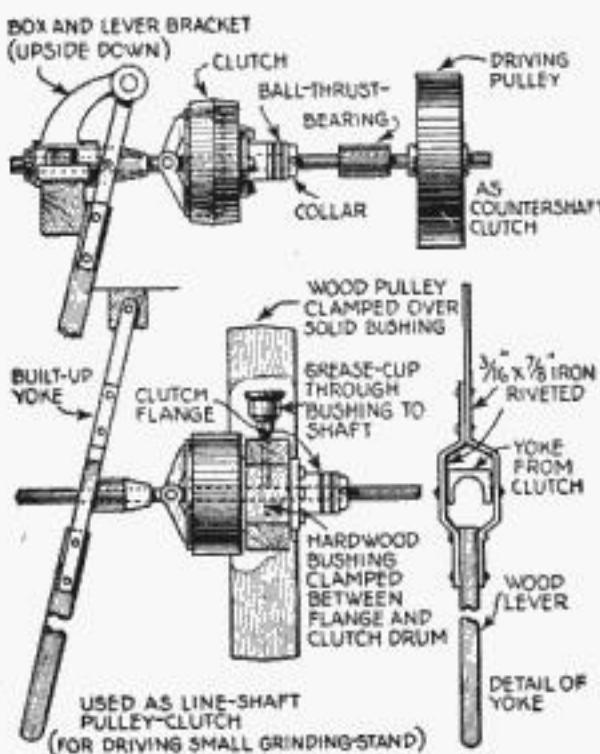
This noiseless capper may be recommended to apartment-dwellers

two heavy wood screws. The position of the block depends on the height of the bottles to be capped.

The bottle is placed on the floor or on a wooden block of suitable height. The metal cap is placed on the bottle, and the capping lever, one end of which is braced against the lower edge of the block on the door-frame, is pressed down on the cap.

Here Is a Use for an Old Marine Clutch

SMALL one-way clutches, intended to be used between the engine and propeller-shaft of low-powered motor-boats not requiring the more expensive reverse gears, are cheap and can often be picked up second hand. They



Showing how an old marine clutch may be adapted to serve as a line-shaft or pulley-clutch

are converted easily to countershaft or pulley clutches suitable for the small shop.

The illustrations show how a light pattern-clutch of the smallest stock size was rigged up to serve as a countershaft clutch to operate a drill-press; also another adapted to act as a lineshaft pulley-clutch, being attached to a 24-in. wooden split pulley connected directly with a grinding-stand. This grinder had formerly worked through a countershaft and a tight and loose pulley, and this intermediate shaft used up so much power that little was left for the grinding-wheel.

The short 1-in. shaft furnished with the clutch was removed and for the countershaft clutch a shaft of the same diameter was inserted. The line-shaft where the pulley-clutch was installed also happened to be 1 in., having been added by means of a reducing flange-coupling. For a larger shaft a larger-sized clutch would be necessary.

The drum was placed in the lathe and turned down and crowned to act as a pulley-face for the driving-belt off the line-shaft. The internal expanding ring was set-screwed directly to the shaft and only revolved when the clutch handle was thrown in. A ball thrust-bearing and set-screwed collar furnished with the clutch were installed forward of the drum-flange to take the thrust from the lever.

One bearing for the shaft was acquired from the combined after bearing and lever-pivot bracket that formed a part of the marine equipment of the clutch. This casting was bolted upside down so that the handle would point down; an extension made of bar iron was riveted on to form a longer operating handle. The only extra parts needed to complete the equipment were a second plain shaft-bearing and the drive-pulley to the drill-press.

To construct the line-shaft pulley-clutch the split bushing was removed from the pulley and a solid one of the same size turned up from a block of hard wood. The flange was removed from the clutch-drum

and the wood bushing bolted between them, forming a long bearing for the revolving shaft.

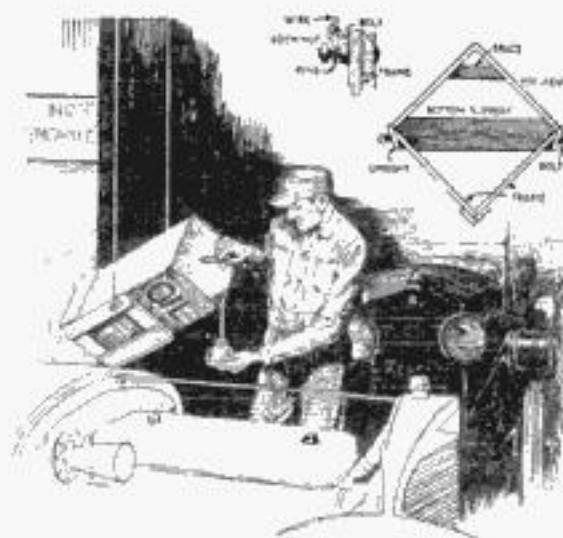
A hole was bored through the center of the bushing and extended through the wooden cross member of the split pulley and a grease-cup screwed in as shown. Then the pulley halves were placed around the bushing and bolted together.

With this arrangement, the whole pulley, flange, and clutch-drum remained stationary on the revolving line-shaft until the clutch-handle was thrown. As before, the expanding drum was set-screwed to the shaft. No extra bearing was used, but a clutch-yoke was built up as shown, from flat iron bent to shape. The bronze shifting-yoke furnished with the clutch was used, the lever being pivoted against the ceiling instead of utilizing the bracket casting as before. A long wooden handle was riveted to the lower end of the iron yoke.

To Handle a Five-Gallon Oil-Can with Ease

IT is difficult to handle a five-gallon oil-can and pour from it without spilling and wasting some oil. I overcame this difficulty in the shop by rigging up the device illustrated here.

The frame was constructed in the manner shown from strips of wood 1 in. thick



If you suspend your five-gallon oil-tank as indicated here, it will be easy to pour from it

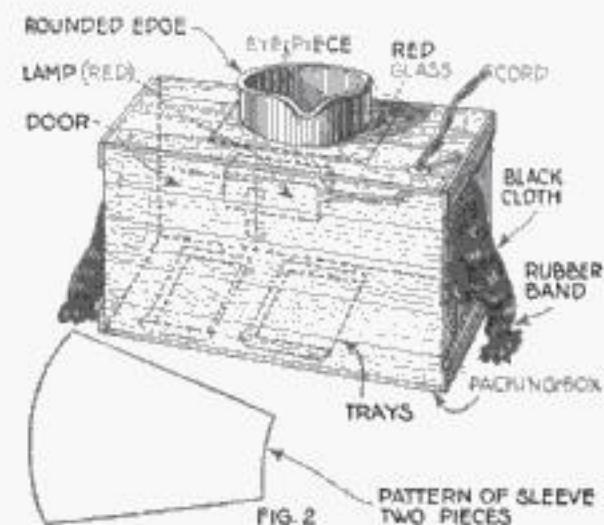
and 3 in. wide. Strong screw-bolts were fastened to the frame at diagonally opposite corners. To these bolts heavy wires were attached, which were fastened with their other ends to hooks in joists of the ceiling. The can, resting in the frame, was suspended at a convenient height and could be tilted easily when it became necessary to draw oil into a small measure or bottle.—B. F. DASHIELL.

Portable Dark-Room from an Old Packing-Box

THE packing-box should measure about 2 ft. by 2 ft. and should be lined with composite board. Care should be taken to see that a tight fit is produced. After the composite board is in place, the inside should be painted with lampblack. Two circular holes about 8 in. in diameter are cut in each end of the box. Two black cloth sacks made up of two pieces of the

shape shown in the picture are sewn together and then tacked over these holes. In the small end of these bags an elastic is sewn. This elastic should be small enough to fit snugly about the arm when the hand is placed through the bag. The cloth of which these bags are made should be heavy enough to prevent the passage of light.

An electric red lamp is now placed at the top of the box on the inside and connections



For daylight developing and fixing, the amateur photographer without a dark-room should make a box like this

made from the outside. The hole where the cord passes through should be carefully plugged to produce a light-tight box. It is not advisable to employ a kerosene lamp or candle in this box, as it will go out, due to lack of air. Now a window is made in the top. A piece of tin pipe cut as shown and provided with a beaded edge is placed on the top. Covering the hole underneath this eye-shade is a piece of red glass.

On one side of the box, near the bottom, a light-tight door should be provided. The trays are introduced through the door and the hands are placed through the black sleeves or bags. By looking down through the red glass plates you may watch the progress of the developing.

This portable dark-room, which may be used for developing plates, films, or prints, regardless of light conditions, should be made large enough to accommodate three trays.

Shoe-Laces Cut from Pieces of Leather

HERE described and illustrated is a tool that will cut shoestrings from pieces of leather that otherwise would go to waste. The tool consists of a small piece of steel tubing sharpened on the edge and fastened to a handle as shown.

Before you begin cutting the shoe-lace, shape the piece of leather as nearly round as possible with your penknife. At a convenient place begin a spiral cut into the edge of the disk, thread the small strip through the sharpened tube of the cutter, and continue the cutting operation by following the outline of the disk with the cutter. In this manner you obtain a spiral strip of leather, the length of which depends on the size of the disk. These leather laces may be used for shoe-strings, lacing of belts, whips, dog-leashes, etc.



This cutter pares shoe-laces from a round leather disk

Children Will Be Delighted with This Roller-Coaster

If you have a high stepladder, a long single ladder, and enough room in your garden or yard, you can easily improvise a roller-coaster that will give pleasure to your children and their friends.

Set up the stepladder and rest one end of the single ladder on top of it as shown in the illustration. Fasten the end securely with strong wire or rope, to prevent it from slipping off. At the foot end of the single ladder drive in two pegs against which the ends of the ladder should rest.

The car is of 1-in. boards nailed together and should be slightly wider than the ladder. The boards are held together by two cleats of 1-in. stock, and on each of the long sides 8-in. boards with hand-holes are nailed or screwed.

The wheels of the car, which are four in number, consist of bicycle hubs set in forked bearings that are screwed to the ends of the cleats. The grooved bicycle

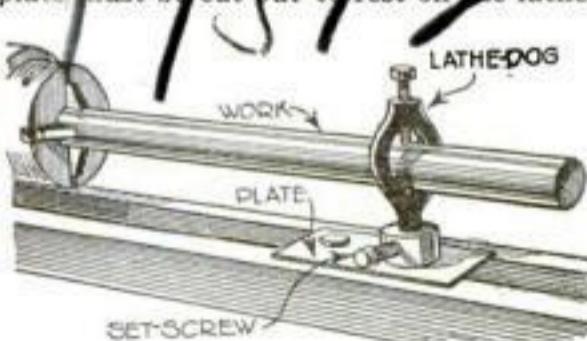


The possibilities of this roller-coaster depend on the size of your garden and the length of the ladder

hubs form the wheels, the side pieces of the ladder the track of the coaster. The car is pulled to the top of the incline by a rope that passes over a pulley attached to the top rung of the ladder.—C. A. BLACK, JR.

An Old Lathe-Dog Used for Center Rest

An old lathe-dog can be pressed into use as a center rest in the manner shown in the illustration. First a heavy steel plate must be cut out to rest on the lathe-



In a case of emergency a good center rest may be improvised from a lathe-dog as here shown

bed. This is held in place with a clamp.

A heavy collar is riveted on the plate and the hole in the collar must be of such a size as just to fit the projection on the dog.

The collar is provided with a set screw so that the lathe-dog can be adjusted to various heights. The set screw is brought down to the proper distance.



This Test Told Millions the way to pretty teeth

Millions of people have already made this simple ten-day test. And the glistening teeth you see everywhere now are largely the result of this method.

We urge you to make it. Then see and feel how your teeth conditions change.

Must fight film

You must fight film to keep your teeth whiter, safer and cleaner. Film is that viscous coat you feel. It clings to teeth, gets between the teeth and stays. The tooth brush, used in old ways, does not remove it all. So very few people have escaped the troubles caused by film.

It is the film-coat that discolors, not the teeth. Film is the basis of tartar.

Ask for this ten-day test

Ask for a ten-day test. Then judge by what you see and feel how much this method means.

Each use of Pepsodent brings five desired effects. It attacks the film in two efficient ways. It leaves the teeth so highly polished that film cannot easily adhere.

It multiplies the salivary flow—Nature's great tooth-protecting agent. It multiplies the starch digestant in the saliva, to digest starch deposits that cling and may form acid. It multiplies

It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. And all these troubles have been constantly increasing.

To daily combat it

Dental science has for years been searching for a daily film combatant. It has now been found. Careful tests under able authorities have amply proved its efficiency. Leading dentists everywhere now advise its use.

The methods are embodied in a dentifrice called Pepsodent. And to millions of people, here and abroad, it has brought a new era in teeth cleaning.

the alkalinity of the saliva, to neutralize the acids which cause tooth decay.

These results all accord with modern dental requirements. Everybody, every day, should get them.

Send the coupon for the 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coat disappears. You will be convinced. Then the benefits to you and yours may be life-long in extent.

Cut the coupon now.

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The New-Day Dentifrice

A scientific film combatant, whose every application brings five desired effects. Approved by highest authorities, and now advised by leading dentists everywhere. All druggists supply the large tubes.

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THE HOME WORKSHOP

New Uses for Electricity

Have you found a new way of making the electric current work for you? Have you made a new labor-saving or money-saving machine or device that is electrically operated? The Popular Science Monthly will pay \$90 in prizes for the best answers

ELECTRICITY is one of our most useful servants. An outline of its more common daily uses would fill a book of no mean size. The editors of the Popular Science Monthly want to find some uncommon uses for electricity. They want to know what new uses readers of the magazine have found for it in home, shop, or office. The new machine or device does not need to be motor driven, although there is no objection to a motor-driven machine, provided it is new and useful. It must, however, be a homemade device. Electric magnets, solenoids, or heaters may be employed.

The Popular Science Monthly offers three prizes for the best answers—a first prize of \$50, a second of \$25, and a third of \$15. These will be awarded in accordance with the rules outlined below.

Rules Governing the Contest

(1) Contestants are not limited to the number of ideas, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The use of the new electrical appliance must be shown clearly, either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably type-written, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p.m., on Oct. 20, 1921.

(5) The judges of the contest will be the editors of the Popular Science Monthly.

(6) The first prize of \$50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best idea of a new use for electricity.

The second prize of \$25 will be paid to the contestant who submits an idea next in merit.

The third prize of \$15 will be paid to the contestant who submits an idea third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the Popular Science Monthly. A description of the ideas that win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts that do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one idea, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

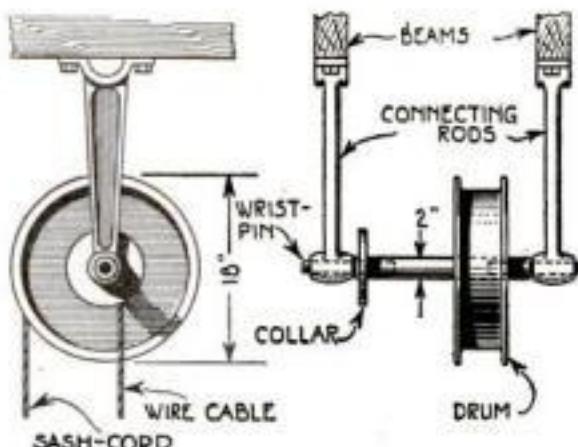
(11) Send drawings and specifications to the Editor of the New Uses for Electricity Contest, Popular Science Monthly, 225 West 39th Street, New York City.

Making a Pulley-Hoist from Scrap Parts

A SIMPLE differential pulley-hoist, suitable for the private garage or small shop, and that will lift a motor or even a body from a car can readily be improvised from discarded parts.

The details of a hoist that can be made from two discarded motor connecting-rods, a section of 2-in. pipe, and a pulley 18 in. in diameter are shown in the accompanying illustration.

Normally, one man can lift a thousand



Work in shop or garage is facilitated by such a pulley-hoist as this

pounds with this hoist. Increasing the diameter of the drum increases the capacity of the hoist.

An ordinary flanged automobile wheel, such as a Ford front wheel, can be used for a drum, and a sash-cord used for the pull-rope. The capacity of this hoist will be about 1500 lbs.

The supports for the hoist should be set close together to avoid bending, and the pivots should be driven securely into the ends of the pipe-drum. The rope used for hoisting, preferably a stranded wire cable of small diameter, should be strong enough to sustain the desired load.—G. A. LUERS.

Surround Your Farm with a Woven Willow Fence

ON a certain farmstead, a portion of the fences are all made of willow saplings, woven basket fashion about the small posts, which are set about 2 ft. apart.

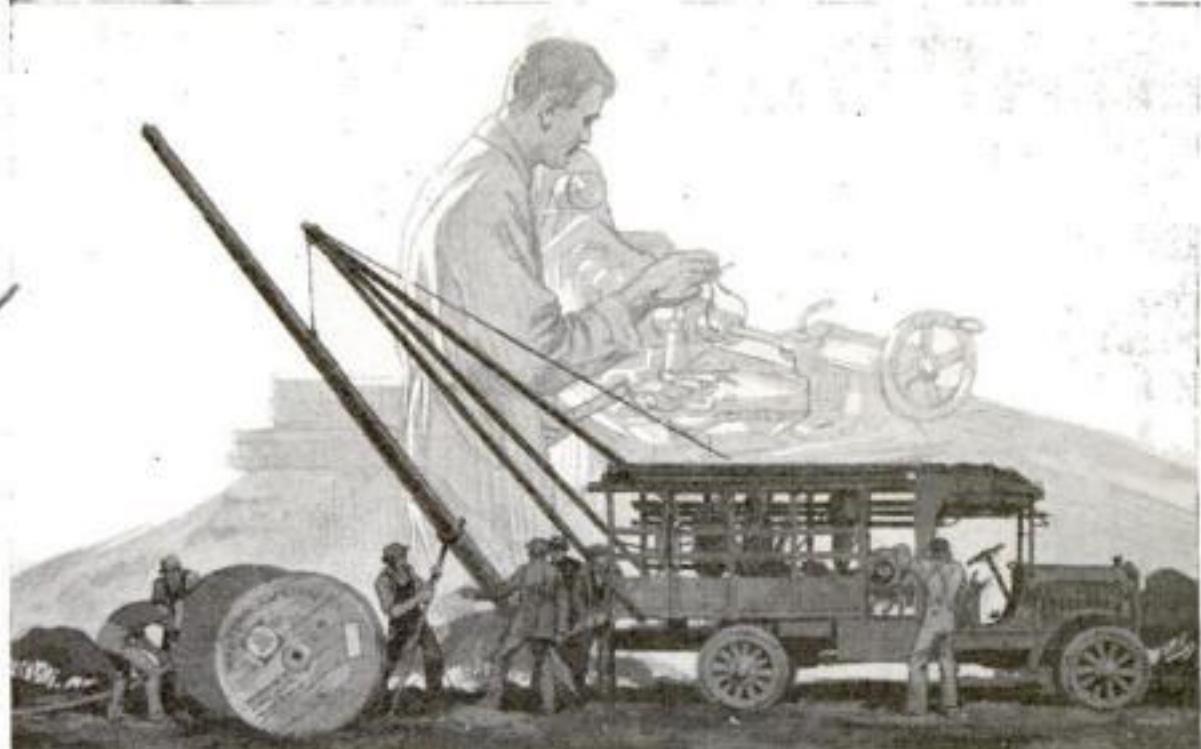
The cottage is of frame construction and is the only building on the place that is not built of the willow saplings. A barn,



Woven willow fences are picturesque and give better protection than rail or wire fences

chicken-house, hog-house, and a corn-crib are all made of willow.

Several years ago, lacking funds with which to properly provide for his stock through the coming cold weather, the owner cut willow saplings and put them to the use shown and described.



Tools of Industry

In industry, art, science, in fact in all kinds of work, good results require good implements kept in good condition.

If the right sort of implement is important to an individual workman, efficient tools for industry and commerce are a vital necessity to the nation.

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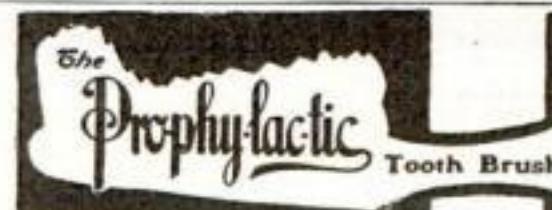
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THE HOME WORKSHOP

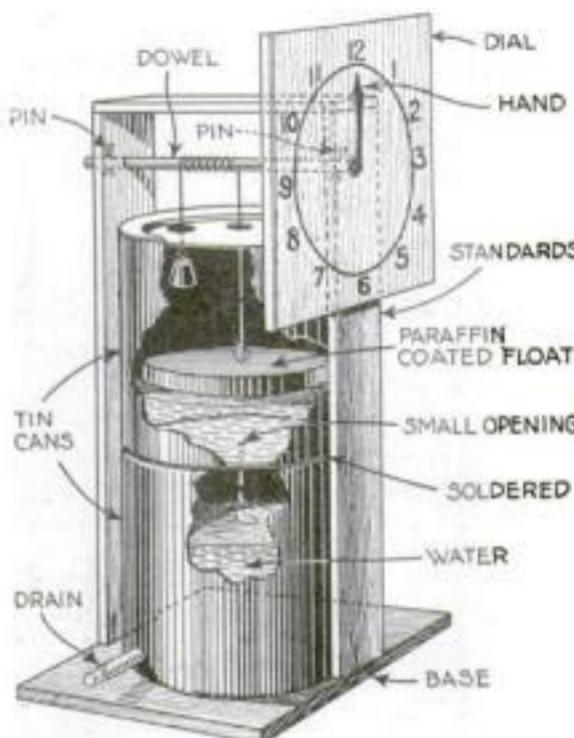
Who Knows How to Make a Water-Clock?

By W. H. Hoschke

BY following the directions here given, a water-clock that keeps fairly good time can be made.

The clock is started on its way by two clean tin cans. They must be water-tight. These cans are soldered together as shown in the illustration. A tiny hole is poked in the bottom of the top can. This hole should be made very small at first, just large enough to permit water to drop through. It will probably be necessary to adjust the size of this hole when the clock is set in operation. If the clock is slow, the hole should be made a trifle larger. If the clock is fast, there is only one remedy—the hole will have to be soldered over and another one made.

Two holes are made in the cover of the top can. These permit the two ends of a piece of cord to pass through. One end of the cord is fastened to a wooden float by means of a small screw-eye and the opposite end holds a small weight. The string is wound around the dowel that carries the single hand of the clock. It may be mentioned here that the float should be soaked in paraffin, otherwise it is apt to become waterlogged and rendered useless. The bearings for the dowel are cut in two upright pieces that extend from the base. A



The homemade water-clock here illustrated is not a toy, but shows the time with fair accuracy

pin is driven through each end of the dowel so that it cannot slide out of place. The hand should be cut out of thin sheet brass, and a hole drilled in one end so that it will just fit snugly over the dowel end. A top piece to brace the two standards is tacked in place.

The dial is made from a square block of wood. A circle is drawn on this and filled in with black ink. The circle can be described with a pair of dividers, one point being allowed to dig into the wood. The circle is then evenly divided into twelve parts, one for each hour. This division must be accurately done if the

device is to keep time. The builder may divide the hours into quarters if he likes. This will make it possible to read time more accurately. The numbers can be painted on or the little paper numbers with glue on the back, obtainable at the stationer's, may be used.

A small piece of brass tubing is soldered into the bottom of the lower can. A cork is placed in this so that the water in the lower can may be drawn off when it is full. The supply of water in the upper can may be replaced by removing the cover. The clock should run for twelve hours before it needs "rewinding."

An Electrically Heated Chicken-Brooder

AN electrically heated chicken-brooder may be readily made from a small wash-tub that will take care of a hundred chicks. An electric bulb forms the heating device and is held inside a tin can, which is soldered to the inverted tub.

The legs for this chicken-brooder are clothespins firmly pushed upon the rim about 10 in. apart, which hold the inverted tub about 2½ in. off the floor. A canvas curtain is also held about the rim of the tub by the same clothespins. This curtain should be cut 3 in. wide and held just clear of the floor. Holes are cut through the canvas curtain where the pins clamp upon the rim of the tub. Slits should be made every 8 or 10 in. along the curtain for doors through which the chicks may enter and leave the brooder.

Several small holes should be punched in the tub to allow pure air to circulate. Various size bulbs may be used to secure various temperatures suitable to the ages

of the chicks. At first the heat under the brooder should be kept around 100° F. A 60-watt bulb will do this easily for a large tub used as the body of the brooder, and corresponding smaller sizes will be found sufficient for smaller brooders. After the chicks are two weeks old, the temperature should be maintained around 70° F.

A 25-watt bulb will run this brooder for a greater length of time when the chicks are kept under it and will be no more expensive than an oil-heated brooder and much more clean and sanitary, as well as far more healthful.



All you need for this chicken-brooder is a small wash-tub, a few clothespins, and an electric-light connection

to get the right heat, and the size of the ventilation holes may be made smaller (by covering with tin disks) to get more heat.

The can used to enclose the electric bulb must be 4 or 5 in. from the floor so that the chicks will not be burned.

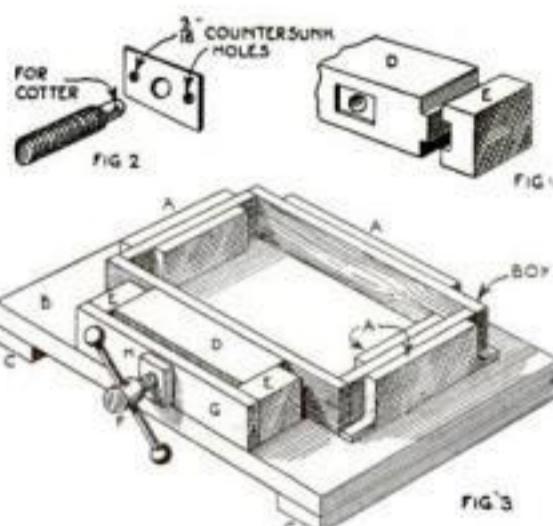
Glue and Nail Sides of Box with This Jig

ILLUSTRATED in the accompanying picture is a jig that was employed in making a small rectangular box in quantity.

The guides A, of which there are five, were fastened permanently to the base B, which was braced with strips C. These guides served to hold the ends and one side of the box in place. The clamping device necessary to force all sides into position, consisted essentially of a movable block D, placed between the guides E which were fastened to the base B.

The movement of block D was controlled by the screw F, threaded in the bearings G and H.

Figure 1 illustrates the manner in which clamp block D and guides E were mortised



For making a large number of boxes of the same size, this jig will be found very useful.

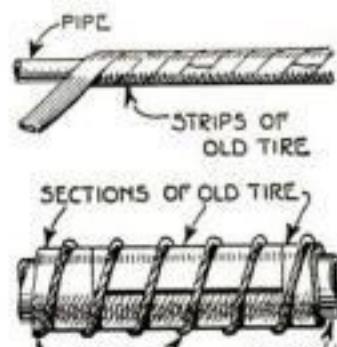
and tenoned, to provide, first of all, suitable guiding to the moving block, and secondly to prevent the same from moving out of position.

Figure 2 illustrates the manner in which the movement of block D was controlled. A shoulder was provided on the end of the screw, fitting into a rectangular steel plate $\frac{1}{8}$ in. thick. This plate was fastened to the block D. Reference to Fig. 1 will reveal the rectangular slot intended to give proper clearance to the plate, and the projecting portion of the screw.

Water-Pipes Can Be Protected with Old Tires

DISCARDED automobile tires may be utilized for protecting or insulating water-pipes from freezing in winter or from becoming heated in summer. For covering pipes of large diameter the full width of the tire, in sections of 18 in. should be used. The sections of tire are wrapped around the pipe, leaving no part uncovered, and are held in tight contact by winding a rope around the pieces of tire.

If the pipes are small, the tire may be cut lengthwise in narrow strips, and wound around the pipes as shown.



Old tires make a good protection for water-pipes

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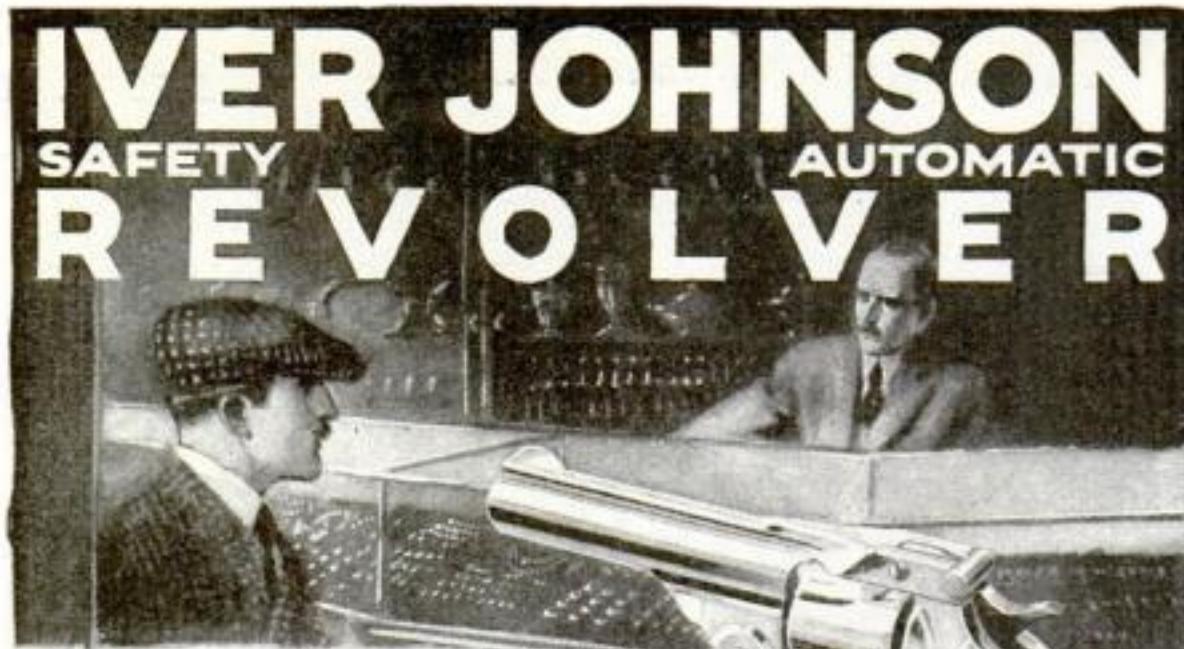
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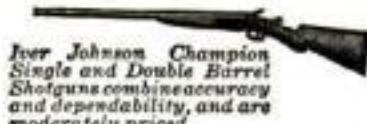
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THE HOME WORKSHOP

A Bread-Slicer that Cuts the Loaf Evenly

IT is merely a short board a little wider than a loaf of bread, and has sides of thin board nailed on to form a box open at the ends. A narrow slot is sawed in the side boards to guide the bread-knife and a narrow block is nailed to the bottom board to act as a gage being the thickness of a slice from the slots.

The knife guide is made near the middle of the board instead of near one end, in order to give more strength to the side



Bread cut in slices of equal thickness is more attractive. Why not make a slicer as described here?

boards. The illustrations show the completed slicer. Bread may be sliced either hot or cold, likewise cakes and cold meat if not too large to be slipped between the sides.—H. F. GRINSTEAD.

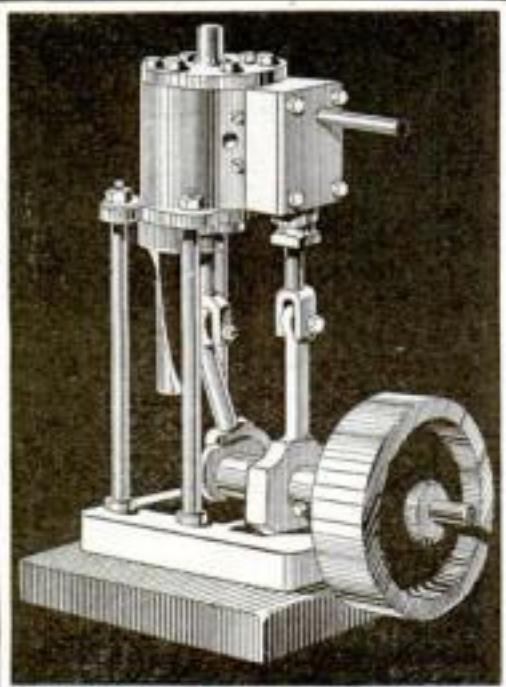
How to Make Emergency Rope from Bark

WHEN out camping or caught in some emergency in the country and in need of a rope or piece of heavy twine, cut from the underbrush sticks from 6 to 8 ft. long. Cut vertical slits around one end from $\frac{1}{2}$ to 1 in. apart, according to the size of the rope you wish to make, and pull off the



Rope braided from strips of bark has surprisingly great tensile strength and flexibility

bark in strips. Tie three of these strips together at one end, hook them to any convenient stub and plait them as girls do their hair. When there is about a foot of the strips yet to be plaited, weave in the ends of new strips of bark, and so on.



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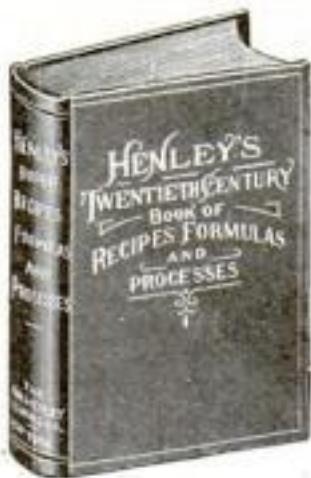
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225 West 39th Street, New York

THE HOME WORKSHOP

This Blow-Torch Fits the Vest Pocket

DESCRIBED below is a pocket blow-torch that answers all the requirements of a larger instrument, at the same time having the advantage of being so



One of these pocket-size blow-torches will be found to be very handy

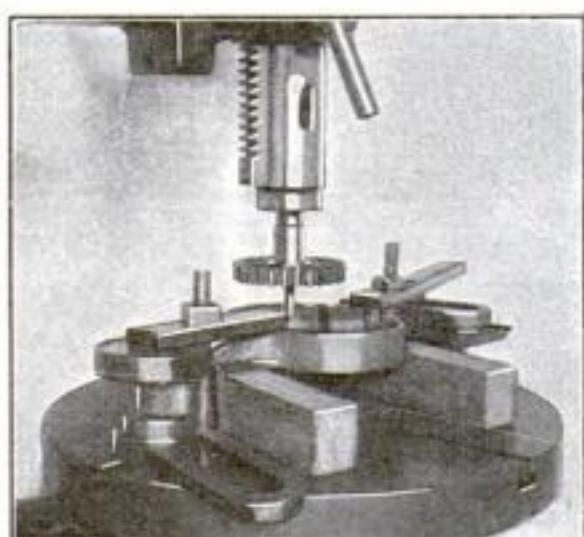
small that it can be carried in the vest pocket like a fountain-pen. It consists of a nickel-plated outer case or tube, with a leak-proof screw-cap at either end, on the side of which is a smaller tube with a blow-hole in the extreme end. At the other end a length of small rubber tubing is attached, which slides along the larger tube and serves for adjusting the flame.

The larger tube is packed with a wick cut flush with the upper end. When this wick is saturated with alcohol, the torch is ready for operation by simply removing the cap from the upper end, touching a match to it, and adjusting the flame to suit.—M. V. TESSIER.

A Vertical Milling Job Done on a Drill-Press

RECENTLY I had a large number of gear-casings to make and when I began to assemble them, I found that there was not sufficient clearance between the gears and the casing.

It was necessary to do this work cheaply and quickly, so the tool shown in the



How a vertical milling job was successfully done on a drill-press

accompanying sketch was made. A spindle was made to fit the spindle of the drill-press. On this was fitted a side miller. The pilot fitted the holes in the casing.

The work was set up on the table of the drill-press, as shown in the photograph. This proved to be a very satisfactory way of doing the work.—HARVEY MEAD.

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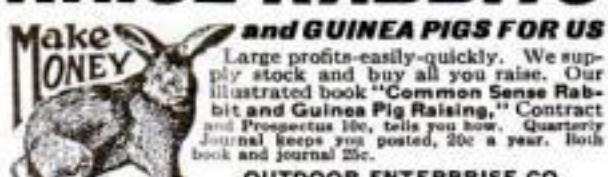
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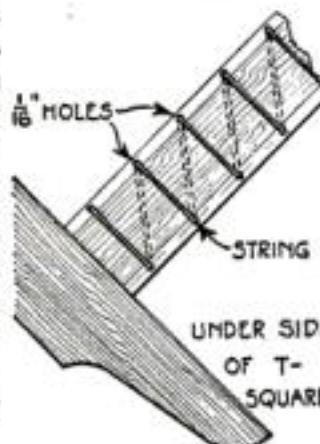
THE HOME WORKSHOP

It Is Possible to Keep the Drawing-Paper Clean

IT is next to impossible to keep machine drawings on detail paper clean, especially where the design is altered and worked over for a long time. Much of the smudging comes from the continual rubbing of the T-square over the pencilled lines.

A suggestion for keeping the surface of the T-square blade from rubbing the lines is to provide a double line of 1/16-in. holes in along each edge of the blade and then to lace in a white cotton string as shown.

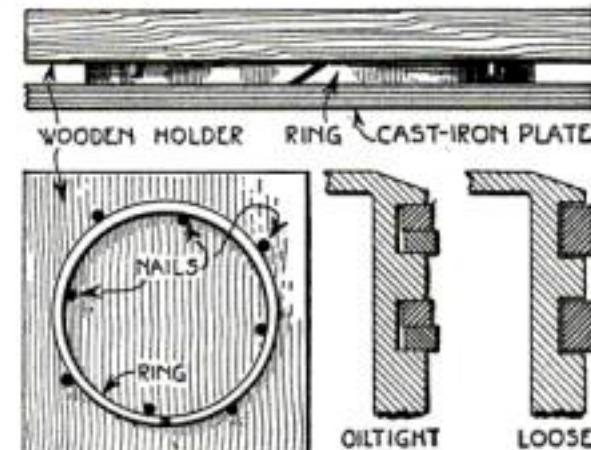
The string should be drawn tightly in position and secured by knots at each end.



A simple method of preventing smudging of drawings

Oil-Tight Piston-Rings Made from Old Rings

DEPENDABLE oil-tight piston-rings suitable for motors that have been in service for a long time can be made from two old rings that are worn to the extent of fitting the ring grooves loosely. When the rings fit the grooves loosely the oil works its way under the ring and in consequence the motor smokes and carbonizes quickly. The ring grooves, if convenient, should be true'd up by chucking the pistons in the lathe and taking a light cut from each side of the groove. The rings are either placed on the face of a grinder and ground to approximately half of the original width, or ground and filed by hand to half



One simple method of making oil-tight piston-rings from old rings is here illustrated

the width. The two rings so ground should be the exact width of the ring-groove. These rings should be placed so the slots fall on opposite sides of the piston. With rings made as described, pistons with over a hundredth of an inch clearance in the cylinders can be made perfectly satisfactory.

If the pistons are worn only slightly, one double ring in the top groove of each piston will give satisfactory results.

The main detail of fitting these rings is to make the width of the combined rings the exact width of the groove. When this is done, the oil that works around the ring is held back and the two scraping faces at the circumference of the ring hold the oil back at this place.—G. A. LUERS.



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225 West 39th Street, New York

THE HOME WORKSHOP

Prevent Rugs from Curling at the Corners

RUGS and carpets that have been in use for some time frequently curl up at the corners. This makes them unsightly and may cause accidents by tripping. The ac-



Sheet-metal corner pieces sewed to the rugs will prevent the corners from curling

companying illustration shows how the curling of the rug corners may be prevented.

Corner pieces of iron or some other heavy sheet metal are sewed to the under side of rugs and carpets at the corners that display a tendency to curl. The weight of the metal will be sufficient to hold the corners down. For the sake of greater convenience holes should be punched through the metal corners through which to draw the heavy sewing-thread.

Drilling Holes from the Bottom Up

IN the miscellany of repair work many holes have to be drilled from the under side. The illustration shows a workman



With this lever arrangement it is just as easy to drill holes from the bottom up as from the top down

who is putting 1/4-in. holes in the lower flange of an auto truck, and doing it easily.

He uses a piece of board to form a lever with which he presses the electric drill and its tool upward. By this means the work is done easily.

If the part to be drilled had been higher up, he would have picked up an odd brick or piece of blocking to elevate his fulcrum.



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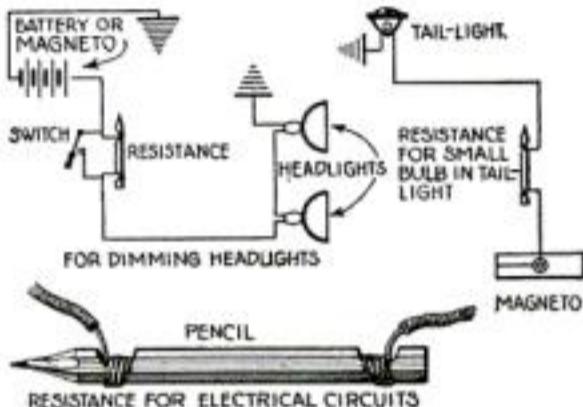
256 pages, 135 illustrations. Price, postpaid, \$1.75

Popular Science Monthly
225 West 39th Street,
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Pencils May Be Used for Electrical Resistance

LEAD from a pencil that is a graphite composition is serviceable as a resistance in electric leads where one is required to overcome excessive current flow. As a simple resistance for dimming headlights of an automobile, a section of lead-pencil can be wired in circuit with the lamps with a switch across the interrupted circuit, permitting the lamps to be lighted full or reduced to a dim light when desired.

With the large magneto, as on the Ford,



Graphite pencils may be used as here shown as an electrical resistance in a lighting circuit

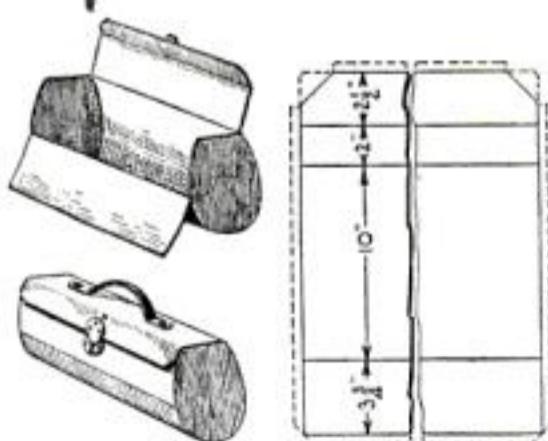
it is desirable to use a tail-light running from the magneto. A lamp-bulb durable enough for this purpose is difficult to secure, because of the increased current flow when the engine is running fast. A section of hard pencil wired in circuit with the lamp affords the required resistance to protect the lamp against burning out.

Of course, a short section of lead offers less resistance than a long section.

Making a Music-Case of Cloth or Leather

HERE is an easy method of making a music-case at very little cost. Get some common bookbinder's cloth, or, if you care to, a piece of leather, and lay it face down on the table. Mark it off as shown in the illustration, leaving $\frac{1}{2}$ in. all around for turning over.

Now get a piece of ordinary millboard and mark it in similar fashion, with the exception of the $\frac{1}{2}$ -in. edges. Score this



With simple materials and a little ingenuity this neat music-case may be made at home

board halfway through with a knife as shown. Make two ends of the same material, or, better still, from a thin board.

Now fasten all together, gluing the leather or cloth to the millboard.



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How to Improvise a Bed for the Baby

SHOULD visitors accompanied by a baby come to your house to remain for a few days and you have neither a cradle, crib, nor baby-carriage, you may improvise a bed for the young visitor if you have a Morris-chair.

Remove the rod supporting the back of the chair, tilt the back until it is level with the seat and support it with a box or low chair. Place a blanket, comforter, and other necessary bedclothes on the impro-

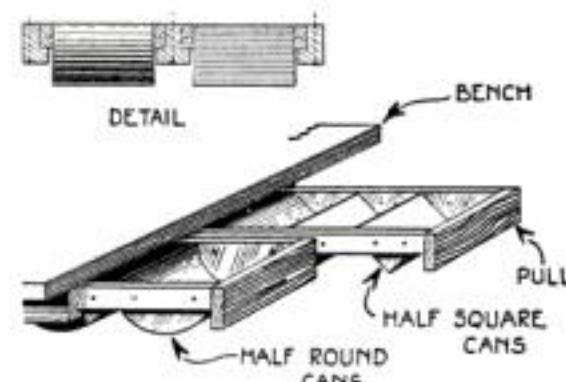


Your Morris-chair, arranged in this manner, will serve in place of a crib to accommodate a little visitor

vised bed and you will have an excellent crib for the baby. The arms of the chair will prevent the squirming little sleeper from rolling off during the night.

These Small Drawers Were Made from Tin Cans

OLD tin cans, cut in half and then nailed on two strips of wood, as shown in the illustration, make convenient drawers in which to keep assortments of nails, tacks, brads, screws, bolts, washers, etc. These small compartment drawers can be pulled out from their slides and carried to odd



Countless are the uses of old tin cans. Here is one adapted to the requirements of home and shop

jobs away from the work-bench more easily than large compartment boxes of wood.

The illustration shows how round or square tins may be used to form the separate compartments in the drawers. If you have enough of these drawers, you may construct a cabinet for holding them. Each drawer should have a front board with a knob and a label indicating its contents.

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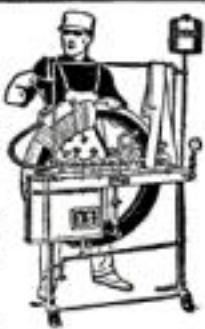
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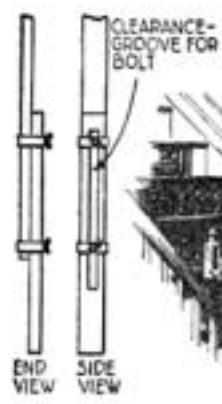
THE HOME WORKSHOP

This Ladder Can Be Used on Steps

THE illustration below shows how a ladder may be arranged to be used on stairs or on uneven levels. The uprights or string-pieces of an ordinary ladder are cut about 1 1/2 in. below the bottom rung and 2-in. holes are drilled below the two lowest rungs and counterbored on the inside face of one of the uprights as indicated in the diagram below.

Two screw-clamps made of 3/4 by 1/8 in. iron are bent into shape and fastened to

One of the string-pieces of this ladder can be extended so as to rest on the lower step



the uprights of the ladder as shown. The clamps act as guides and hold the extension leg in a position parallel with the upright. The wood extension leg is made of the same material and size as the uprights; about 28 in. long.

A clearance groove for a 1/2-in. bolt is cut in the center of the extension leg as shown. Two wing-nuts make it possible to set and fasten the extension leg to give the ladder a vertical position with a firm bearing on two steps.—D. KRIESEL.

For Cutting Holes with a Bearing-Ball

WHEN paper gaskets are to be fitted on differential covers, crank-cases, timing-gear covers, and transmission cases, it is necessary to punch a large number of holes through the gasket. These holes must be of the correct size and placed accurately to coincide with the bolt-holes in the rim. Usually the holes through the

gasket are made with a punch, but this method is apt to give inaccurate results. A much better method is here illustrated.

The paper gasket is placed in its proper position on the rim of the differential cover, and a steel bearing-ball, slightly larger than the bolt-holes, is pressed down on the paper over each hole. A slight tap with the hammer will cut the hole through the paper smoothly and exactly in the right place.

Cut the bolt-holes
in the gasket as
shown



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How to Clear a Camp of Poisonous Reptiles

RATTLESNAKES and copperheads add an element of danger to camping in the wilder sections of the country. A little knowledge of the habits of these reptiles enables campers to destroy them.

The hill in the illustration has been denuded of trees by the artist to show the snake-hunter how to proceed. In the fall the snakes go into dens in the rock ledges and in the spring they come out again. In these seasons search the cliffs, examining every hole that appears to lead back into the hill beyond the frost line. Some day the snakes will be found going into or coming out of a den by scores or hundreds. Sometimes two hundred are found within a radius of fifty feet.

By the time summer camps open, the last of June or first of July, the reptiles have scattered. The rattlers hunt rats, mice, chipmunks, and other small animals in fields and underbrush. Copperheads are more apt to be found along streams and in marshy places. To find them in the daytime it is usually necessary to turn over stones and logs. They hunt at night. A systematic search of a camp-site will bring them to light.

Hunters' feet and legs must be protected by heavy shoes and leggings. Hands must



Autumn and early spring are the seasons for exterminating the poisonous snakes

not be laid on any doubtful spot. In case of a bite, cut crisscross gashes with the fang-marks as centers, suck out the poison, rub in permanganate of potash, and send for a doctor. Drinking whisky increases the danger.

Harmless snakes should not be molested. They are economically valuable.

The Best Known Method of Breeding Meal Worms

THE meal worm is the larva of a black beetle known as *Tenebrio molitor*. The larva is yellowish and represents the first stage in the development of the beetle from the egg. This larva sheds its skin a number of times and from it the pupa, the resting-stage develops. Finally the pupa turns into the beetle that lays its eggs for the next generation.

In order to raise meal worms a large earthenware pot or jar, glazed on the interior, is used. This jar is filled with bran, some flour, and a few linen rags until two thirds full. Woolen rags do not serve this purpose; they only favor moths, which are injurious to the meal worm.

It is advantageous but not absolutely necessary to place a few pieces of insect-bored wood to a height of about 1 in. at the bottom of the pot. The wood is covered

with a layer of rags. Over this place the bran, then a few more rags, flour, and bran, until two thirds full. To start the colony, place meal worms, their larvae, or the full grown insects into the jar. Then the jar is covered with a piece of cloth tied firmly about the edges. The rags are moistened from time to time.

It is best to begin breeding these worms in the spring. Let the pot stand during the



Follow the directions given and you will have a good crop of meal worms

summer, occasionally moistening the rags, and in the fall, seven to eight meal worms can be removed daily and fed to birds, tree toads, chameleons, or turtles.

A Simple Way of Making Cement Steps

STEPS are made of various materials, according to the use they are to serve. For the garden, wooden steps are unsuitable, since they do not last long enough.

Permanent steps have a greater value, and since they are easy to make, should find more universal application. Broken or partly broken, glazed or unglazed, drain-pipes can be successfully used. These pipes are placed into the position the steps are to occupy. They are slightly sunk, so that they will remain in position.

When the steps are in place, cement is made, and a layer of about $\frac{1}{2}$ in. applied. Then a number of flat stones are carefully imbedded in the cement, and more cement



Steps for the garden made of stones and broken drain-pipes bound with cement

is added to fill all cavities and depressions.

The flat stones not only save a large quantity of cement, but they also give the proposed steps the required shape.

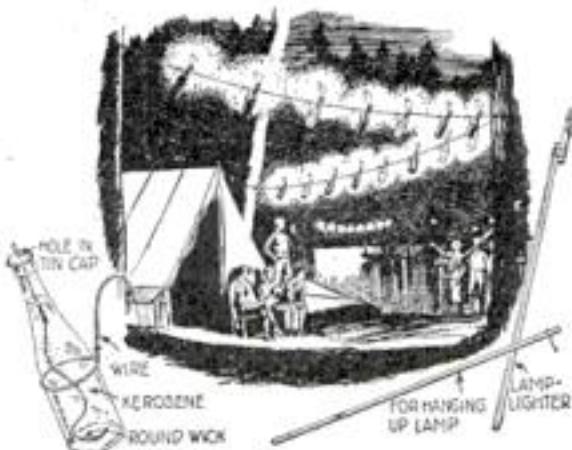
Use 1 part of cement with 7 parts of sand adding water to obtain the desired consistency.—E. BADE.

Lamps Can Be Made Out of Empty Bottles

SUMMER campers who take pride in their camp can easily make a brilliant display of illumination by turning the empty soda-bottles to use. For gala occasions there is no sight more welcome or romantic than the darkness of the woods broken by an array of lighted torches.

The ordinary small soda-bottles are the best to use. Punch a hole in the tin cap just large enough for a lampwick to go through. The round wicks are the best to use, but if not at hand a small flat wick will do. If wicks are not obtainable, several pieces of cord twisted together will serve. Insert the wick into the cap so that $\frac{1}{2}$ in. projects. The bottle is filled with kerosene and the rest of the wick immersed. The tin cap is fitted on the bottle and the torch is ready for use. A piece of wire is looped around the bottle and the other end of the wire bent into a hook, enabling one to hang the torch at any desired place.

For the most effective arrangement of lights a wire should be strung from one tree



Lamps made of bottles containing kerosene and suspended from wires will make your camp more cheerful on a dark night

to another and the bottles hung on the wire equal distances apart.

To hang up the torches or take them down, a pole with the head of a nail projecting at the top is very convenient. However, the bottles need not be taken down more than once every few days to adjust the wick or replenish the kerosene. To light the lamps while they are hanging, use a lighted candle tied to the end of a pole. To extinguish the lamps, the burning wicks need only be covered for a moment with the end of a stick. To vary the effect of the bottles they can be hung on the trunks of the trees or suspended from the branches.

To Soften Aluminum for Repoussé Work

ALUMINUM will make a very good substitute for copper for repoussé work, if it is rendered sufficiently soft. To do this, heat it slowly until it glows red in the dark, rub it with a lump of fat, and the moment the black mark left by the carbonization of the fat disappears, remove the plate from your annealing oven or substitute, and cool it fairly quickly.

Both aluminum and other metals may be used much thinner than is usually done by amateurs, if the heaviest indentations are made with wooden blocks while the pitch bed is kept slightly warm, finishing as usual, and, if very thin, backing with melted lead or white metal.

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THE HOME WORKSHOP

Keep the Mosquitos Out of Your Tent

YOU should cover the entire front of your tent with netting so that you may keep the flaps of your tent open and at the same time prevent mosquitos and other insects from flying in.

The netting should be cut and sewed the same shape as the flaps, with enough



Mosquitos are a menace. Keep them out by overlapping flaps of netting

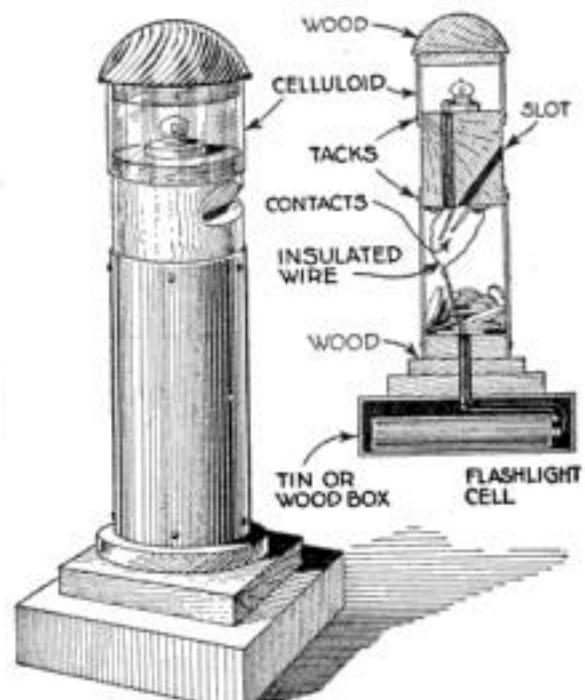
material for the two sides to overlap. Then the netting is sewed to the top of the tent entrance. When the flaps are rolled up, the netting acts as a screen.

To prevent the netting being blown about by the wind, weights should be fastened along the bottom.—B. Fox.

This Bank Flashes when a Penny Is Dropped In

JUST a few scraps of material found about the house and this little lighthouse bank is easily made. The body of the lighthouse is made of a piece of sheet tin or brass bent to form a tube and is nailed to the wooden base, which is cut out round.

A piece of large enough tubing



Every time you drop a coin in this bank the lighthouse lamp will flash

would serve the purpose as well. The top piece has a slot cut in it with two contact pieces. The coin dropping between the pieces closes the circuit and flashes the lamp in the top. The lamp chamber is made of a small strip of sheet celluloid. The battery is placed in the base of the bank.



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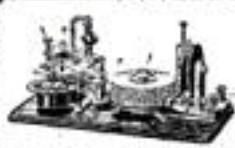
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THE HOME WORKSHOP

Teaching the Fish to Ring for Their Meals

IT is far more interesting to tame sunfish and other finny visitors along the edge of a lake than to catch them. A few angle-worms distributed each morning will soon bring a large school and they will become so tame as to eat from the hand.

To an overhanging limb attach a lever switch wired to an electric bell on the tree or in the tent or cottage. The switch can easily be made from a strip of brass, slightly bent and mounted on a block, with a light spring under one end to hold it away from the contact point on that end. One wire of the bell circuit is attached to this contact point and the other to the pivot of the switch. Two or more dry cells furnish the current.

From the other end of the switch a line is hung. This is baited with a worm strung



Nature lovers will have fun educating fish to signal for food by ringing

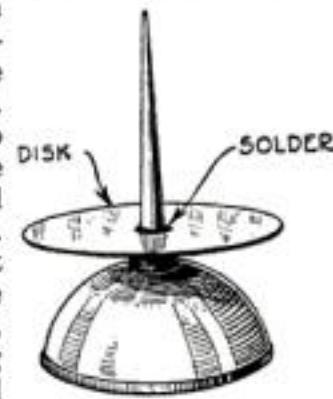
on a thread. No hooks! The fish pulls down, closes the circuit and rings the bell. If worms are thrown in from the shore, it may be found that the fish will continue to pull the string after the bait has all been pulled from it. If fed at a regular hour in the morning, the fish will appear regularly each day.—ARMSTRONG PERRY.

A Non-Spilling Oilcan for the Tool-Chest

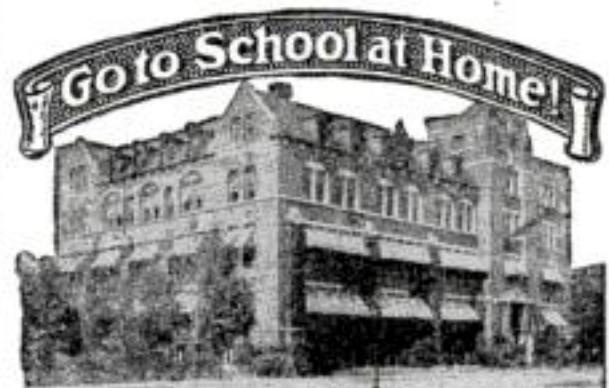
WHAT is more disgusting than to open up the tool-box and find that the oil-can has tipped over and smeared the interior with a slimy, oily mess that necessitates removing everything and cleaning house? To prevent this put a safety guard on the spout as shown.

Cut out a disk of stiff tin or other convenient metal slightly larger in diameter than the bottom of the oil-can. Then cut a small hole in the exact center, making this so that it will be a snug fit around the spout near the bottom. Smooth off all rough edges with a file or emery-paper and slip the disk in position. Then touch a drop of solder above and below, and the guard is done.

The oil will not run out when the can is capsized, the guard holding it so that the end of the spout is elevated. — L. B. ROBBINS.



It is simply impossible to upset this oilcan



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Let us show you how to get on the road to success. It will not cost you a single working hour. We are so sure of being able to help you that we will cheerfully return to you, at the end of ten lessons, every cent you sent us if you are not absolutely satisfied. What fairer offer can we make you? Write today. It costs you nothing but a stamp.

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<input type="checkbox"/> MECHANICAL ENGR.	<input type="checkbox"/> ILLUSTRATING
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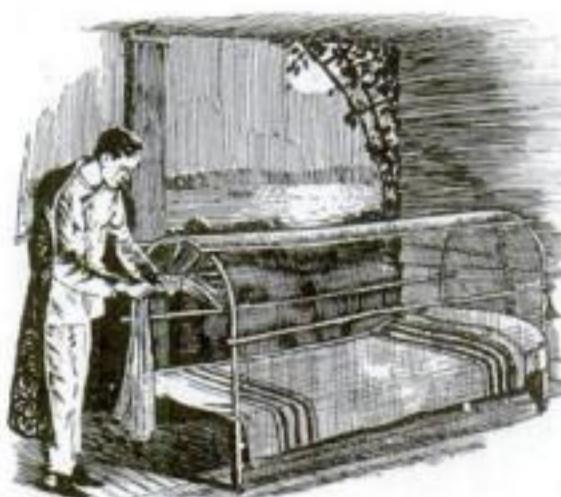
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THE HOME WORKSHOP

Protecting the Outdoor Sleeper from Mosquitos

WITH a few branches or sticks a simple framework can be made that can be put up or taken down in a minute. Mos-



Sleeping out of doors may be made comfortable by providing a cover of mosquito netting supported by a light framework

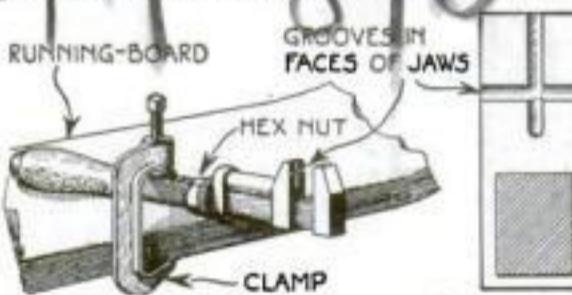
quito netting hung over this framework offers the sleeper full protection.

Two long branches that can be bent into semicircles form the end supports of the framework. The ends should be sharpened to a wedge shape. These ends can be wedged into the joints of the cot at the head and foot and in this manner will be held firmly in place without any nailing or tying. Four sticks, long enough to reach from one hoop to the other, are cut and nailed to the hoops as shown in the picture. Over this framework mosquito netting is placed and small weights tied to the bottom of the netting to keep it down. The sleeper can easily creep into the cot from either end.

By simply pulling out the wedged ends of the hoop the entire canopy can be lifted off bodily. To replace the canopy at night means only to push the wedged points in place.—B. FOX.

How a Wrench Will Serve as a Vise

ONE of the needs of the motorist who travels away from his home workshop is some sort of a portable vise. For this purpose a 15-in. monkey-wrench will serve



Motorists find a monkey-wrench with a hexagonal nut a good substitute for a vise

if arranged as shown in the illustration. A heavy wrench is at all times a desirable tool, especially where the steering-gear becomes bent or it is necessary to remove a wheel. Likewise the C clamp will serve all purposes, from repairs to a broken spring to the removal of a tire from a rusted rim.

Select a wrench with a hexagonal nut for adjusting the distance between the jaws. Usually the tool-kit contains an open-end wrench that will fit this hexagonal nut for adjusting. Alter the jaws of the

monkey-wrench by filing the cross slots as shown in the picture. This is to obtain better gripping, especially on round stock. Clamp the wrench to the running-board or other surface with the C clamp and the motorist has a small but dependable vise.

One Way of Fooling Trout while They Watch You

TROUT fishermen usually fish a stream rapidly, believing that the fish will bite at once or not at all. Any one who has the patience to sit or stand quietly by a clear pool for half an hour can prove that trout—even big trout—will come out in plain sight and bite a hook.

The fisherman must remain perfectly motionless until the trout appear. Then, very slowly, he can raise his rod and lower his lure into the water; half an inch a second is about as fast as he can move at first, but after half an hour he can walk very slowly along the bank. He may place



Casting is not the only method of catching trout. This way is equally effective

his bait under the nose of a trout a dozen times without effect and then get him at the thirteenth trial.

When a stream is lined with fishermen and the water is low and clear a cautious fisherman may get half a dozen good trout out of the pool in a day, while other men fish two or three miles of stream and go home with an empty creel.—A. PERRY.

A Poker-Chip Holder from a Solid Block

HERE is an innovation in poker-chip holders. It is made from a single block of wood measuring about 8 in. square. The block should be trimmed perfectly smooth and then four holes are drilled at an angle of 30 degrees about three-quarters through the block. These holes are indicated by the dotted lines. Then a saw cut is made, cutting part of the block away so that it

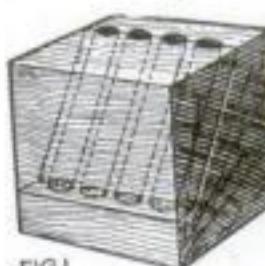


FIG.1

How to make a poker-chip holder from a solid cubical block of wood



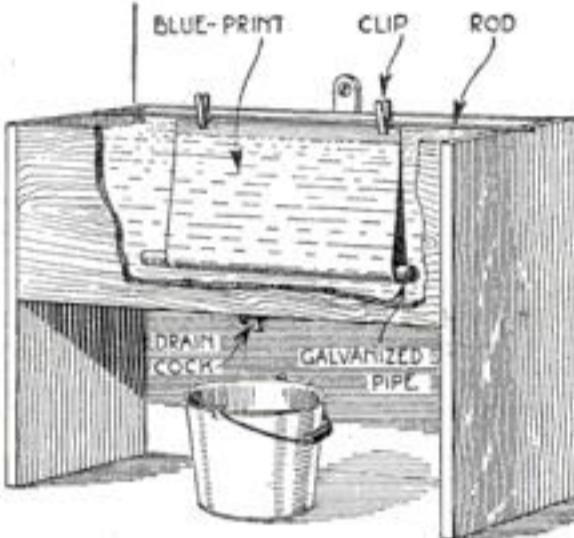
FIG.2

will appear as shown in Fig. 2. The holes are cut just halfway through. Of course the holes must be just a bit larger than the poker-chips.—W. H. HOSCHKE.

Try a Vertical Tank for Washing Blueprints

A HORIZONTAL sinklike washing-tank such as is commonly used for blueprints occupies more room space and is more difficult to install than the narrow vertical tank here illustrated.

In making this type of tank the end



Economy of ground space is the important feature of this washing-tank for blueprints

boards may be extended below the tank bottom to serve as legs or supports. A draincock for emptying the tank into a bucket should be provided.

The blueprints may be clipped to a supporting rod in a doubled position and a piece of pipe may be used as a sinker weight.—EVERETT ROGERS.

Improvising a Dividing Head for the Lathe

DIVIDING heads are not supplied with ordinary lathes and the amateur usually finds it necessary to do without one. The screw-cutting gears may be pressed into service for this work in the manner shown.

HEAVY WIRE
SCREW
60-TOOTH GEAR

A good substitute for a dividing-head way the proper division can be made for different work.

Various Methods of Making Wood Fireproof

KEEPING wood wet, coating with suitable paints, and using certain chemicals are the three methods of increasing fire resistance tested at the United States Forest Products Laboratory at Madison, Wisconsin. Painting, while not the most effective, is the cheapest and most practical treatment in small accounts. A paint of linseed oil, zinc borate, and chrome green retained its fire resistance for years.



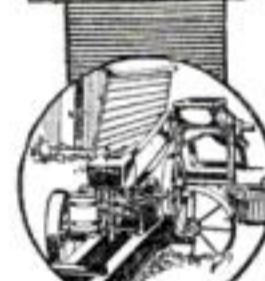
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You start and stop saw blade without stopping motor by simply pulling out Friction Clutch. A great time-saver and convenience.

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The price of the OTTAWA Log Saw is now so low that any man with wood to cut cannot afford to be without one.

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Makes the OTTAWA saw the Human way—the easiest, quickest and safest way. Most powerful motor.

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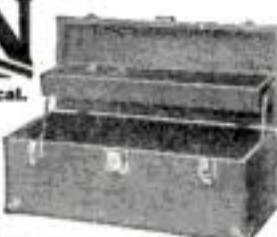
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The Central Auto Supply Co. Eng. Dept. 122 Louisville, Ky.

THE HOME WORKSHOP
Learning to Aim Your Rifle Accurately

By Frederick C. Davis



Accurate rifle-shooting is an art which requires skill acquired only by persistent practice.

AIMING a rifle is a simple yet difficult matter. All rifles with fixed sights are so adjusted by their manufacturers as to necessitate aiming them in one certain way in order to place the shot where it is desired. Often the user of a gun believes it inaccurate, when in reality he does not aim it correctly.

The rear sight of a rifle is shaped like two hills with a valley between, while the front sight projects upward and presents, when viewed from behind, the appearance of a narrow projection like a tiny pole; sometimes a ball (head) is affixed to the top of the front sight.

When the rifle is held to the shoulder and the eye sighted along the barrel, it is possible, with a little practice, to see three things at once: the rear sight, the front sight, and the spot where it is desired the shot should hit. In order to place the bullet where desired, these three things must be adjusted relatively to one another in just one way.

The correct way to aim is this: adjust the rear and front sights so that the peak (tip) of the front sight is exactly level with, and equally distant from, the two peaks of the rear sight. Each of these peaks must appear to be of the same height, and the middle one should be in the exact middle. The barrel is now adjusted, but in order to point it directly at the desired spot, it must be moved (without changing the positions of the three peaks) so that the spot to be hit is directly over and touching the tip of the front sight. When the trigger is pulled, the bullet will hit in exactly the desired spot.

Any alteration of the relative positions of the sights will cause the bullet to miss the mark. In the second diagram of the top row note that although all three sight peaks are of equal height, the front sight is not equally distant from the two peaks of the rear sight. The front-sight peak is closer to the left rear-sight peak than to the right rear-sight peak. The result is that the bullet hits several inches to the left of the desired mark.

The black spot appearing to rest on the tip of the front sight in each diagram is the spot it is desired to hit.

The third diagram in the top row shows the same defective aiming, but in the opposite direction.

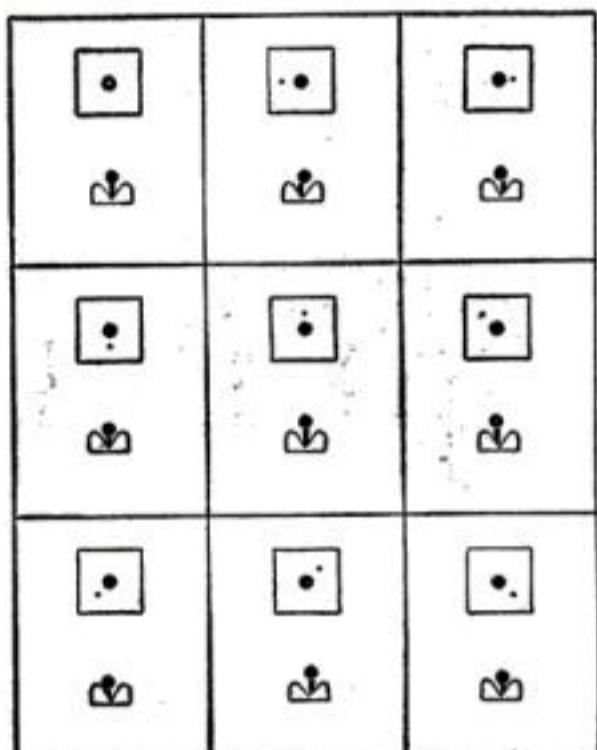
In No. 1 of the middle row another mistake is made. Although the front-sight peak is equally distant from the two rear-sight peaks, the middle peak is not of the same height as the other two peaks; the middle peak is shorter. This causes the bullet to hit directly under the desired spot.

The next figure illustrates the exact opposite of the one before. The middle peak is higher than the two outside peaks. This causes the bullet to hit several inches higher than is desired.

The sixth figure shows a double mistake; this incorrect aiming is a combination of the mistakes illustrated in Figs. 2 and 5; the shot hits upward and to the left.

The figures in the bottom row illustrate incorrect sighting, combining two elemental mistakes in each.

Another mistake the marksman is apt to make is the tilting (canting) of the rifle—that is, turning it slightly on its side. The two peaks of the rear sight must at all times be horizontally level.



Showing how the positions of the two sights affect the aim of the marksman

The only correct method of aiming, then, is this:

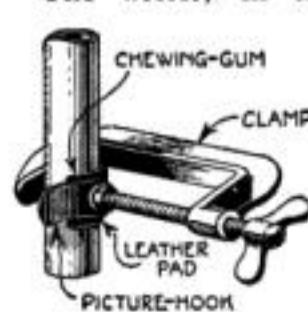
Adjust the rifle barrel so that the front sight peak is equally distant from, and of the same apparent height as, the two peaks of the rear sight; then place the tip of the middle peak directly under and touching the spot to be hit.

How to Stop a Leak in a Water-Pipe

WHEN a leak in a water-pipe is discovered, sals or pants are hurriedly requisitioned to prevent an inundation; but that does not stop the leak.

The writer, in the face of such an emergency, combined a brass picture-hook (hammered to the proper curve over the leaking pipe) and a ten-cent clamp, as shown in the illustration.

A leather pad and a "hunk" of chewing-gum under the picture-hook made the combination perfectly effective.—J. D. ENFIELD.



An inexpensive way of stopping a leak

Display Your Colors in Your Buttonhole

FASTIDIOUS dressers like to wear a flower in the buttonhole of their lapel. A bit of bright color enhances the artistic effect of the otherwise somber costume. But flowers of the desired color are not always in season. In such case, a pretty and attractive substitute for a flower may



This buttonhole decoration is not a flower, but a little pinwheel of colored glazed paper.

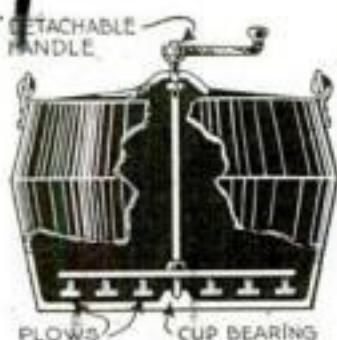
be made from a few small pieces of glazed paper in the desired color or colors.

From the bits of glazed paper a little pinwheel is made, the pin of which is stuck through two thin little disks cut with a sharp knife from the cork of a medicine bottle. One of the disks should be in front, the other on the reverse side of the lapel and the pin should pass through the button-hole. The point of the pin should be clinched to prevent it from slipping out of the disks. If made carefully, the pinwheel will rotate in the slightest breeze.

Stir the Stew to Keep It from Scorching

PROLONGED and persistent stirring is necessary to prevent the scorching of soups, stews, sauces, etc., while they are simmering over the fire. The danger of scorching is greatest for the thicker parts of the stew, nearest to the bottom of the pot or pan, because that part, being directly over the fire, is exposed to the fiercest heat. Scorching may be prevented by the use of a mechanical stirrer as shown in the accompanying illustration.

The device consists of a rod of iron that forms the shaft of the stirrer, a cross piece, also of iron and provided with several T-shaped plows, which is permanently attached at right angles near the lower end of the vertical shaft, and a crank handle for rotating the stirrer. The shaft passes through a hole in the cover of the pot and its pointed lower end rests in a cup-bearing that is preferably hard-soldered to the bottom. The crank handle is detached when it becomes necessary to remove the stirring device in case the pot is to be used without stirrer.—WILLIAM A. JACKSON.



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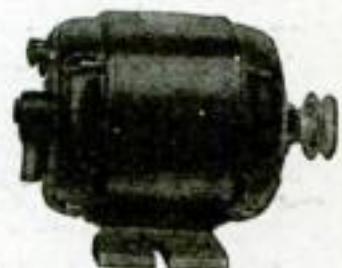
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Micrometer Depth Gauge No. 607

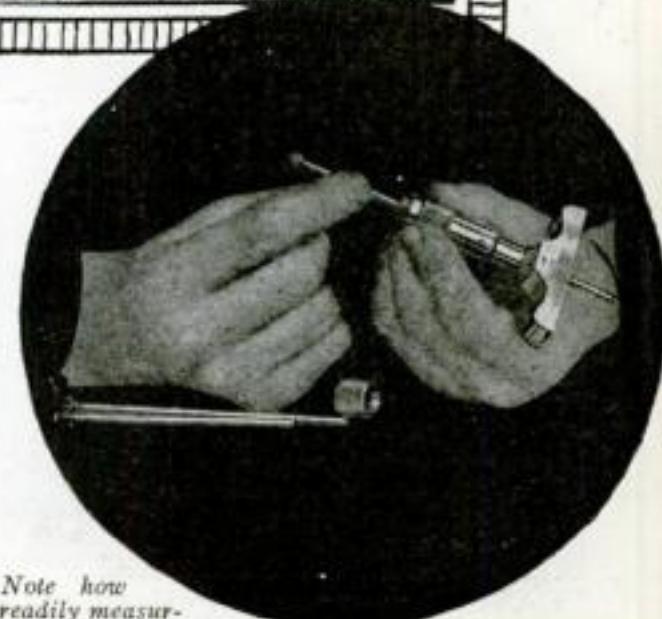
THE service and satisfaction-giving qualities of Brown & Sharpe Tools are a reflexion of the pride and care with which they are built.

This new tool, Micrometer Depth Gauge No. 607, is of a design which appeals to the users of fine tools and its excellence will be appreciated through every-day use.

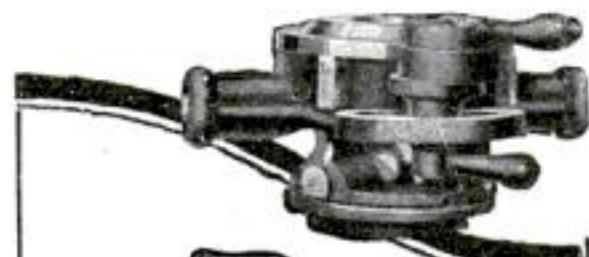
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Circular describing this new tool together with Small Tool Catalog No. 28 sent to any address.

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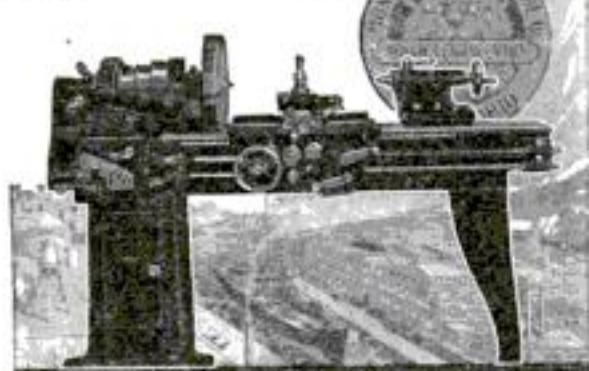
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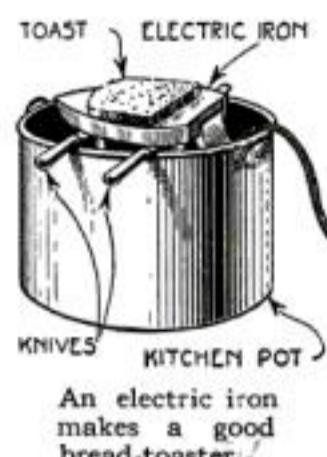
WANTED—A Representative in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

THE HOME WORKSHOP

Did You Know an Electric Iron Is a Fine Toaster?

A THRIFTY housewife who did not wish to buy an electric toaster discovered this method of supplying her husband with toast at the breakfast-table. An ordinary kitchen pot will serve as the base and two knives as the support.

If so desired, a bracket to hold the iron in its position of flat side up can be made easily. Bend up two strips of iron and fasten them to a wooden base. The space between the strips of iron should be wide enough to receive the handle of the iron.—B. FOX.



An electric iron makes a good bread-toaster.

An Improvised Pencil-Holder from a Wire Clip

PAD-PENCILS are apt to slip out of your pocket when you stoop unless they are provided with a clip similar to those on fountain-pens. A serviceable holder may be improvised for any pencil from a wire paper-clip and a thin rubber band.

Bend the clip as shown in the illustration and fasten it with the rubber band as indicated. By pressing against the raised end of the clip the opposite end will be lifted sufficiently to be slipped over the edge of the coat pocket.—HERBERT NEANDER.

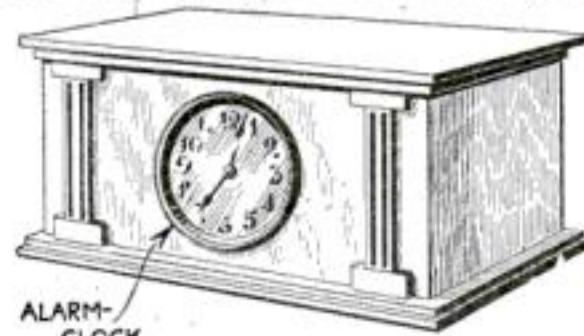


Not ornamental,
but very useful

This Mantel Clock Was Made from an Alarm-Clock

A VERY presentable little mantel clock can be put together with the use of an alarm-clock. First the box is made. This should be nicely sanded and painted with filler, after which it is again sanded and varnish applied.

The hole in the front of the box is made just large enough so that the face of the clock will show. Two small pillars are cut out with a coping-saw and these are glued



Build an attractive casing around your alarm-clock and you will have a useful ornament for the mantle.

to each side of the box front. Of course the design can be elaborated by the mechanic. The back of the box is left open so that the clock can be wound.—G. BENDER.

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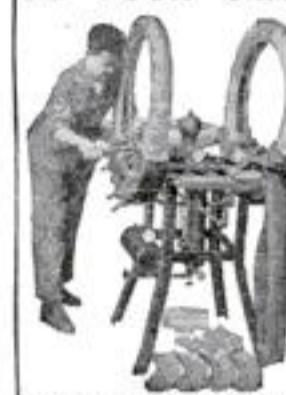
Size	Tires	Tubes
30x8	\$6.50	\$1.60
30x8½	6.50	1.75
31x8½	6.75	1.85
32x8½	7.00	2.00
31x4	8.00	2.25
32x4	8.25	2.40
33x4	8.50	2.50
34x4	8.75	2.60
31x4½	10.00	3.00
32x4½	11.00	3.15
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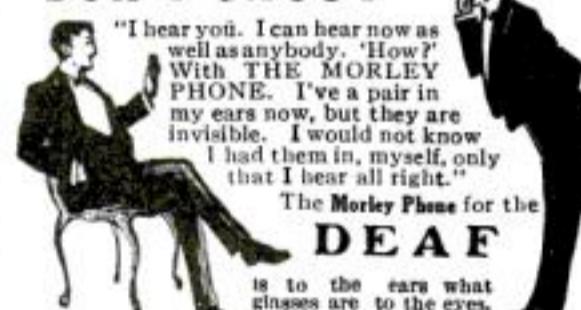
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How to Make a Simple Weather-Glass

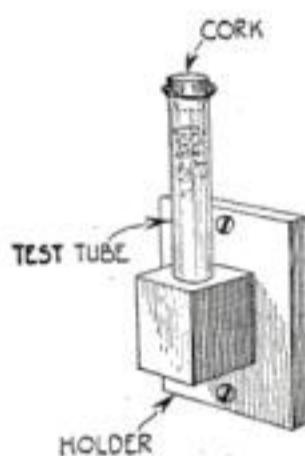
TO make a weather-glass, fill with the following solution a test-tube about 10 in. long and about $\frac{3}{4}$ in. in diameter. Camphor 2 dr., saltpetre (potassium nitrate) $\frac{1}{2}$ dr., pure salammoniac (ammonium chloride) $\frac{1}{2}$ dr., absolute alcohol 2 oz., and distilled water 2 oz. Shake these together and gently heat to dissolve. While the solution is still warm, pour it into the test-tube, filling it to within an inch of the top and then seal the top. Put the tube in a little wooden stand or some kind of holder, and place it out of doors.

When bad weather is coming, you will see a feathery crystallization at the top, and the lower it falls the longer the cold will continue.

When the upper part is clear with crystals in the body, rising to the top and collecting, expect windy and stormy weather.

If the upper part becomes cloudy and thick in cold, fine weather, expect wet. If small clear crystals rise, the liquid remaining clear, in fine warm weather, expect rain.

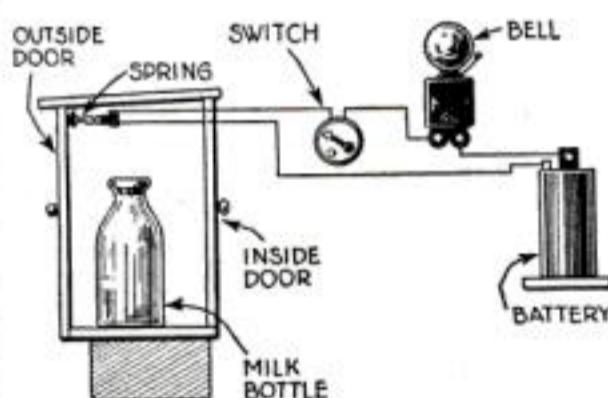
Sharp-pointed featherlike formation is a sign of fine weather; when these break up and become cloudy, expect unsettled weather.—E. A. McCANN.



This weather-glass is more reliable than a corn

When the Milk Is Delivered the Bell Rings

OPENING the outside door of the built-in box or cabinet shown in the accompanying illustration automatically closes an electric circuit that rings a bell and in-



When the milkman brings the milk, the opening of the cabinet door will automatically cause the bell to ring.

forms the housekeeper that the milkman has delivered the milk. When the door is closed, the two contact springs, which have a tendency to meet, are held apart by an insulating plug attached to the door and is forced between the contact springs when the door is pushed shut.

The cabinet or box may be permanently built in, taking the place of one of the panels of the rear door, or may be set in a window that can easily be reached from the outside. The cabinet may be provided with an additional door, opening toward the inside of the house.

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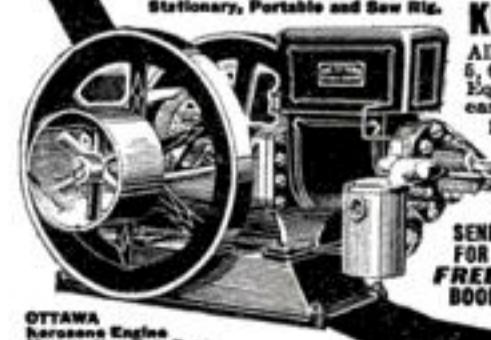
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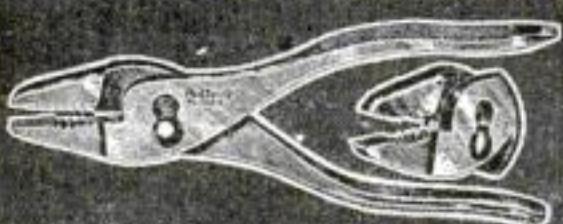
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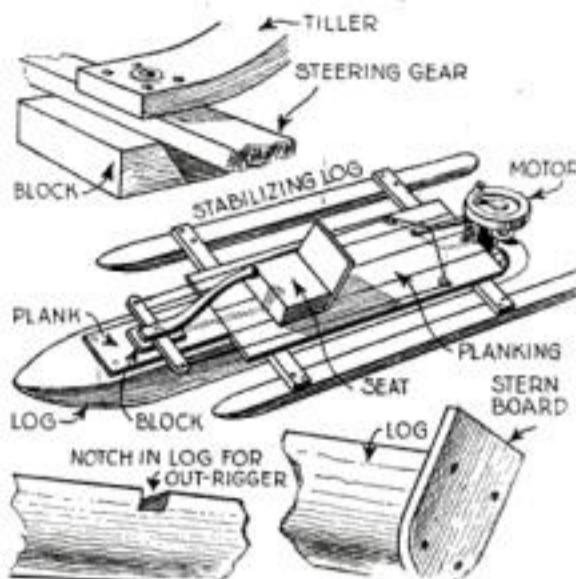
How to Build a Log Knockabout

By L. B. Robbins

THE main part of the "hull" of this knockabout consists of a large well seasoned log. To make a boat that is buoyant, select a log from 16 to 18 ft. long and at least 20 in. in diameter—2 ft. would be better. Saw down one end at a slight angle—about the same angle as the stern of a rowboat. The opposite end can then be hewn to a point with the hatchet to represent the bow. Curve up from the bottom, as shown in the illustration, so that the sweep of the curve will clear the water line a few inches from the extreme end on the bow.

In the middle to the top of the log and at right angles to it, saw a notch 4 in. wide and 2 in. deep, as shown in detail; 1 ft. from the stern cut a similar notch.

The outriggers for the stabilizers consist of two pieces of 2 by 4 in. about two thirds the length of the log or from 11 to 12 ft. in length. Lay an outrigger in each notch and fasten to the log with two or three large spikes. Set them so that the same amount of timber projects at each side and so that they lay parallel. If the bottoms



Build a knockabout like this now, and enjoy it when the season opens again

simply two smaller logs about 15 ft. long and from 6 to 8 in. in diameter, to the ends of the outriggers. The back end of them should project beyond the main log at least 1 ft. If placed correctly, they should almost touch the water when the main log is floating on an even keel.

The tiller is nailed rigidly to the steering-bar and a loose bolt run through the two and fastened solidly to a wooden block on a plank which forms the forward deck.

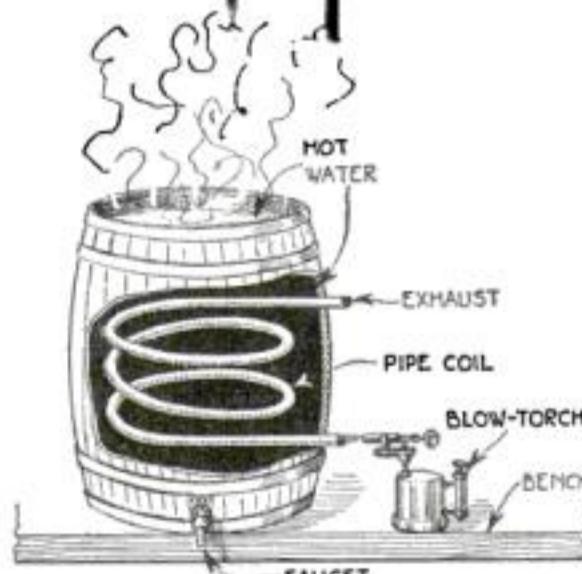
An outboard motor of any conventional type is then clamped to the stern board.

Controls from the motor can be led to one side of the seat.

This Blow-Torch Boils Water in Wooden Barrels

A GASOLINE blow-torch cannot be praised too highly for its many, many uses on the farm, yet there are new functions being added to the list daily. Here is another simple one you might add:

A coil of 1½ in. galvanized iron piping



The flame of the torch heats the air in the coil and the hot metal soon causes the water to boil

is placed within the base of the barrel, removing the upper head. One end protrudes through the wall of the barrel at the same height as that of the nozzle of the torch when set on the bench or ground beside the barrel, and the other comes through 1 ft.

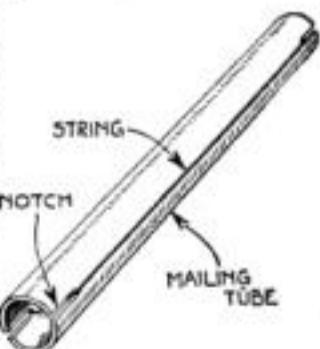
higher, but on the opposite side. The pipe is coiled around in the barrel 3½ times, giving about 10 ft. of surface exposed to the interior. The pipe is bent by heating it in the forge a few inches at a time and pressing it around a circular body. The entrance or lower end protrudes through the stave ¾ in. to receive the blaze of the torch.

The barrel is filled with water, the torch is lighted and set beside it with the nozzle and blaze pointed directly into the entrance of the pipe, throwing intense heat into it. Soon the water will seethe and bubble with heat. A faucet is provided at the base of the barrel to draw off the heated water.

A Better Way of Using a Mailing-Tube

WHEN photographs or other articles are mailed in mailing-tubes, the ends often protrude and become battered during transportation. In some cases the article becomes lost.

By cutting four notches in the mailing-tubes and placing a piece of string in the position shown, the material in the mailing-tubes cannot find its way out. The label bearing the address can be glued over the string.— Try this idea when using a mailing-tube



An Easily Lowered Flagpole for the Yard

WHAT do you do when the rope on the flagpole breaks? Most flagpoles are not strong enough to support the weight of one attempting to fix it. Nothing remains, therefore, but to dig up the pole, splice the rope, and then replant the pole.

Not so with the pole shown in the illustration. Two 4-in. pipes, cased, are set in concrete in the ground to a depth of 4 ft. These are spaced 4 in. apart. Two pairs of holes are drilled through both, one pair at the top and the other about 1 ft. from the ground. The holes of each set are on the same level.

The pole consists of four sections. The first section is of 3-in. pipe 14 ft. long; the next is 12 ft. long and 2½ in. in diameter; the third section is 10 ft. long and 2 in.

in diameter, while a last is 8 ft. in length and 1½ in. in diameter. These four sections are connected with reducing couplings and the top is equipped with a small snap, with another one 2 or 3 ft. down.

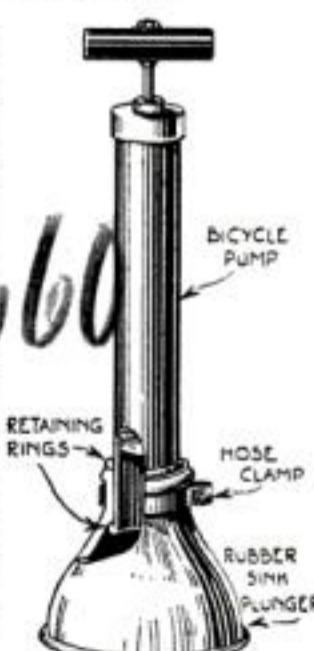
Bolts are run through the pairs of holes in the stationary pipes and through holes in the base section of the staff. When the pole is to be raised or lowered, the bottom bolt is removed, allowing the pole to pivot on the other. When the pole is thus lowered, the flag may be easily attached, or, in case of a storm and at night, as easily removed.—DALE R. VAN HORN.

This High-Pressure Plunger Cleans Drains

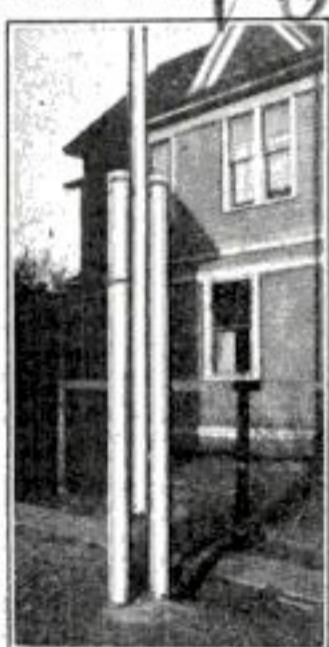
BY combining an old bicycle pump with a rubber plunger-cup in the manner indicated in the illustration a highly effective apparatus for cleaning obstructed drains may be made.

The foot part of the bicycle pump with the delivery tube attached is removed and brass collars or ferrules are soldered to the cylinder to hold the narrow part of the rubber plunger-cup in place.

To make the connection airtight under pressure, a hose-clamp is fastened tightly around the neck of the plunger, between the two collars. The pump develops powerful pressure.



Few obstructions in the drain will resist this high-pressure plunger



This staff can be easily lowered or removed



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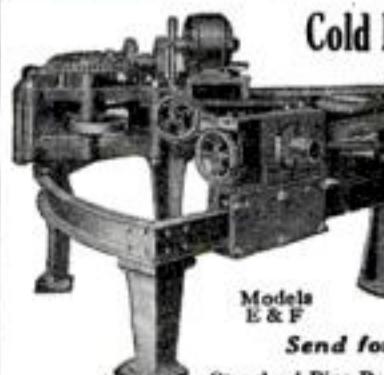
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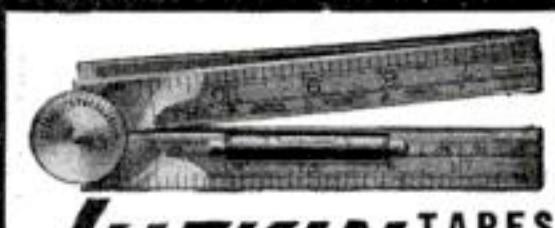
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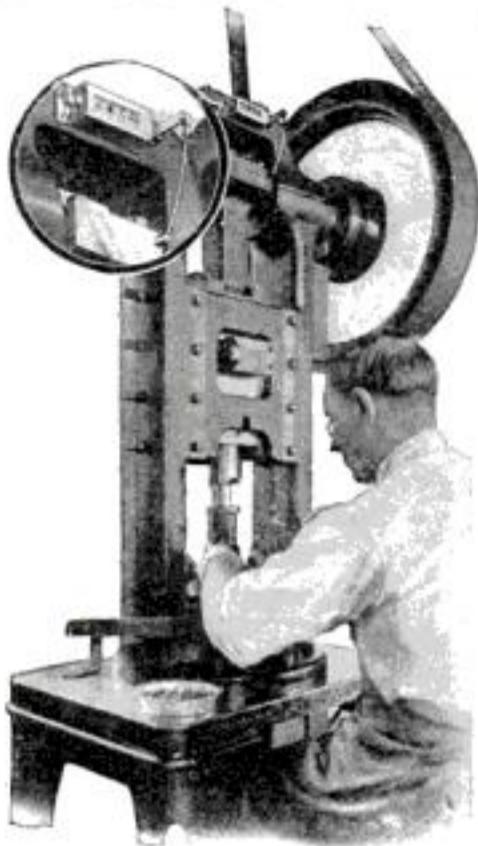
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Showing a Veeder Counter of the large set-back type on a Blake & Johnson arch press, counting the work as produced.

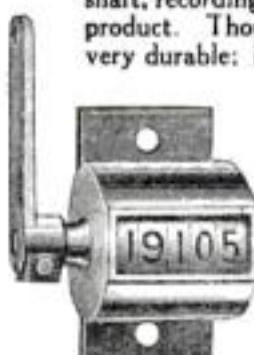
What You Most Need to Know

Production is the big consideration when you build, buy or operate a machine; the reason a

Veeder COUNTER

should go on a machine before you consider it complete. With a Veeder Counter attached, a machine indicates not only its production, but the mechanical moves or operating methods that ensure you the most production.

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable: its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward, the counter subtracts. Price \$2.00. (Cut nearly full size.)



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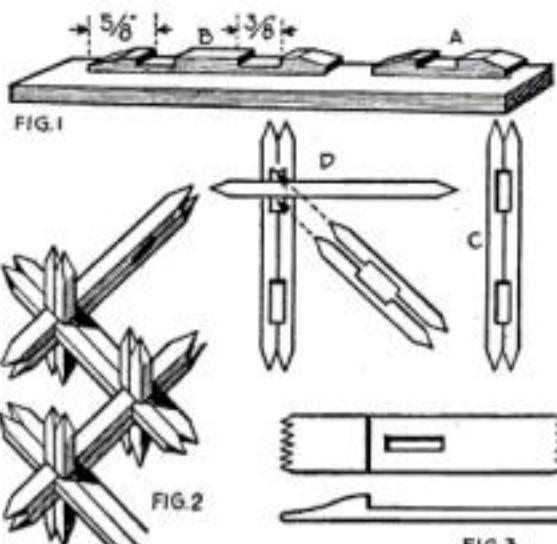
Make Picture-Frames with a Pocket-Knife

By E. McCann

DESCRIBED below is the way sailors of old used to make picture-frames from cigar boxes. First they made a mold or pattern (Fig. 1) out of hard wood; a flat base with a side piece $\frac{1}{2}$ in. wide and $\frac{3}{16}$ in. thick. At one end they cut a mold for the single pieces, $1\frac{1}{2}$ in. long, with a slot in the middle $\frac{3}{8}$ in. long, and half the depth of the side piece tapered at each end. At the other end they made a mold for the double or key pieces, $2\frac{1}{4}$ in. long, with a slot of the same length having its center $\frac{5}{8}$ in. from each end, the ends tapered like the short mold (b).

They then cut a number of strips of wood, $\frac{3}{16}$ in. square in cross section, and pointed and slotted them using the pattern for guiding the knife. The same number of long and short pieces was cut.

Next they placed a pair of two-slot pieces slot to slot (c), held them together with another pair (d), and locked them with a one-slot pair. The same was done with the other end and so on until one side of the frame was completed. For the corner a three-slot hair was required on the inside and a one-slot hair on the outside. The corner was sometimes extended by



Idle hours may be pleasantly spent making picture-frames from cigar-box wood

making it of three-slot pieces. A wider and firmer frame was made by using three-slot pieces all around instead of two, and the top was sometimes built up in the form of a crown by the use of four- and five-slot pieces.

The glass, picture, and back could be set right into the spikes, but it made a neater job to fit in $\frac{1}{2}$ -in. strips of wood with a rabbet for the glass.

The sailors often used different colored woods to vary the design. The completed frame was then varnished so

that it could be cleaned by rinsing in soapy water.

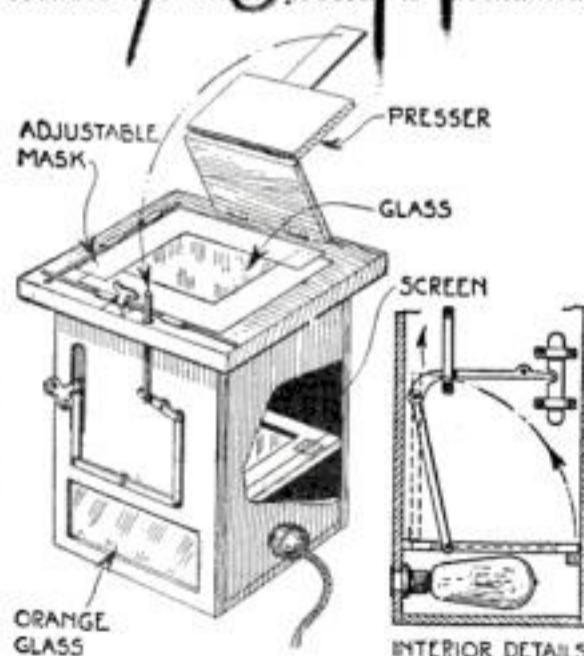
A more simple frame can be made from pieces of wood $2\frac{1}{4}$ in. long by $\frac{1}{2}$ in. wide and about $\frac{3}{16}$ in. thick. Cut them as shown in Fig. 3 and pass the thin end of one through the slot in the other until you have enough to encircle your picture. Make the slot in the last piece wide enough to slip over the head of the first and jamb it with a wedge of wood or little nail.

Do not make the pieces fit too tightly or they will not bend without breaking.

This frame looks well made in alternating light and dark wood, and should be fitted with an inner frame like the other one.

You May Have Your Own Electric Printer

HE who has an electric printer knows how much time is saved by this simple little device. It makes uniform pictures because the whole process is mechanical



Ambitious amateur photographers will find this homemade printing-box useful

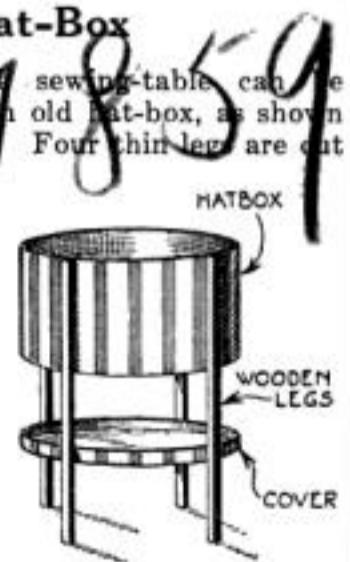
The printer can be made from any sort of a box. The wood should be about $\frac{3}{4}$ in. thick. The box is cut down to 8 by 9 by 12 in. The cover must be 1 in. in thickness and extend 2 in. on each side. In the center of the cover a large opening is cut in which

a glass plate is placed. Near the edge of two of the sides brass rods are placed on which the two masks can slide. These masks are made from thin tin and must be cut accurately. The hinged presser is made in two parts; an iron flange engages it, and, when it is pressed down, it is held in place by a hook. The other extremity receives a bar, which, by means of levers, lifts a yellow or orange screen, allowing the print to receive the light.—E. BADE.

A Sewing-Table from an Old Hat-Box

A NEAT little sewing-table can be made from an old hat-box, as shown in the illustration to shape from a piece about 1 in. thick. The legs can be about 1 in. square; they should be about 30 in. high.

The legs are carefully sanded and then tacked to the box. The tacks are driven from the inside of the box into the legs. The cover is then put in place underneath the box and this is held in the same manner.



A new use for an old hat-box





What to Do to Grow Mushrooms Successfully

OF all mushrooms, the edible mushroom is the easiest to cultivate. Eight different species are found growing wild.

Mushrooms never grow in direct sunlight. A uniform temperature of about 53 to 60° F. and a fairly moist condition of the atmosphere, without being very damp or dripping with water, will cause them to attain their highest perfection.

Under cultivation mushrooms can be raised at any season of the year, while the wild species are restricted to the fall. Mushroom beds can be laid out in some shady nook during the summer, or the hotbed can be utilized if it is kept well shaded. Light does not injure the growth of the fungus, but dryness and the heat of the sun retard its development. The most favorable places for its development are natural caves, underground passages, cellars, or similar places where the temperature can be so regulated that it is uniformly about 60°. Slight ventilation, such as will cause a gradual evaporation, is found to be a necessity.

The higher fungi live on putrefying and decaying material. They cannot take their food from the inorganic salts of the soil as do the higher plants, but are dependent upon other organisms. The substances that they use for food are those that serve or have served other plants or animals for food. This must be given the cultivated mushroom in the form of stable manure.

Fresh manure should be obtained. This should include the litter used for bedding the animals, unless coarse weeds have been used. Stable manure that has been well trampled is nearly always well preserved and is frequently much richer than any other kind.

The manure is piled in heaps about three feet high. It should be watered until well moistened throughout, but not drenched. About a week later it will become necessary



Mushrooms, wild or cultivated, constitute a food nourishing and delicate

THE ball-and-socket connections in steering-gears are in need of constant adjustment to avoid shake and rattle. A method of overcoming this periodic removal of the cap and filing for clearance, is shown in the illustration.

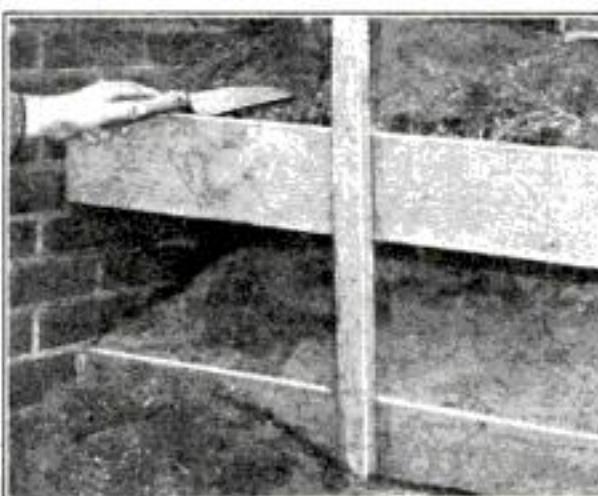
When the cap of the bearing is removed, the surface of the cap is filed or ground until $\frac{1}{8}$ in. of metal is removed. A gasket is then cut from a piece of leather.

This is soaked in oil and the cap is then replaced with this leather gasket under it.

By E. Bade



Rich black humus, such as may be found in the woods, is essential for covering the mushroom-bed.



The soil should be mixed with loam and lime and spread smoothly over the mycelium-bearing manure.

to fork over or "turn" the manure. A second turning is required ten days later. If it has always been well pressed and moist, the manure will not burn and, moreover, there will be no tendency to sour fermentation. In from 15 to 21 days the temperature will begin to fall, the violence of the decomposition will show a subsidence, and the compost will be ready for the construction of the bed. The bacteria of rapid decay will become less and less abundant and finally, when the beds are prepared, the spawn will be able to grow in spite of the bacteria present. The compost is considered ready for the beds when nearly all objectionable odors are lost and a sweet fermentation, as growers term it, has begun.

In making a flat bed for the cultivation of mushrooms, the entire floor space may be utilized or the beds may be arranged in the form of tiers or shelves. The manure is placed to a depth of about 2 ft. then firmly packed. Leave it to cool for a day or

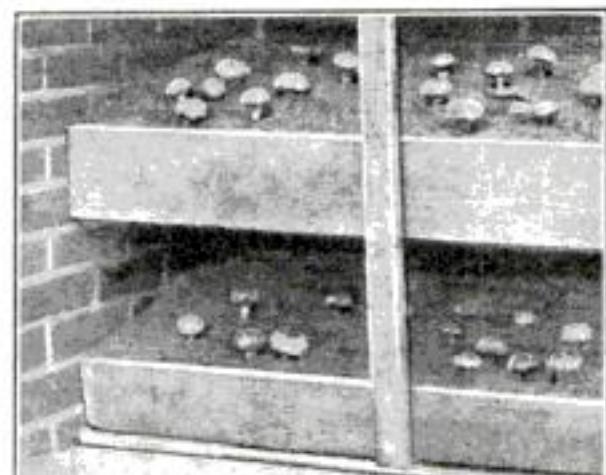
two and when it shows a temperature of about 45°, the spawn can be introduced. Mushroom spawn is sold in the form of bricks and contain the mycelium or the germinated spores of the fungus. The spawn-bearing clay is chipped and the chips placed in the manure at a distance of about 6 in. from each other. The entire bed is now covered with straw and left for about two or three weeks.

The thread-like mycelium of the fungus grows with exceeding rapidity and soon extends its delicate network throughout the bed. After this has taken place, the beds are covered to a depth of $\frac{1}{2}$ in. with a moist layer of good garden or hotbed soil. It is best to mix it slightly with loam and lime. The soil is pressed firmly on the bed, but before adding it, it should have the same temperature as the place in which the mushrooms are cultivated.

When the soil becomes lighter in color, it should be carefully moistened with luke-warm water to prevent the drying out of the threadlike growth of the mushrooms. In the course of the fourth or fifth week the first mushrooms make their appearance. They do not come forth singly, but in groups, so that it pays to harvest them. Now is the time for good ventilation. Also see to it that the moisture content of the beds remains as constant as possible. Never let it become dry or partly dry. This prevents full development.

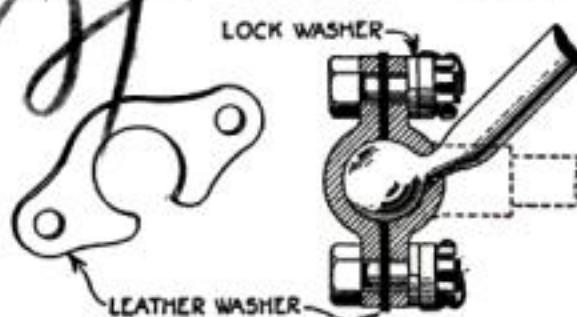
When harvesting the mushrooms, it is immaterial whether they be all fully developed or not, but it is best to wait until the umbrella gains in width.

The life of a mushroom bed is from 2 to 3 months. At the end of this time the exhausted manure is removed and the beds are thoroughly cleaned and aired before a second crop is started. Although mushroom culture is not restricted to any definite season of the year, the best results are obtained during the spring.



After four or five weeks the mushrooms yield a bountiful harvest

Ball-and-Socket-Joint Rattle Can Be Eliminated



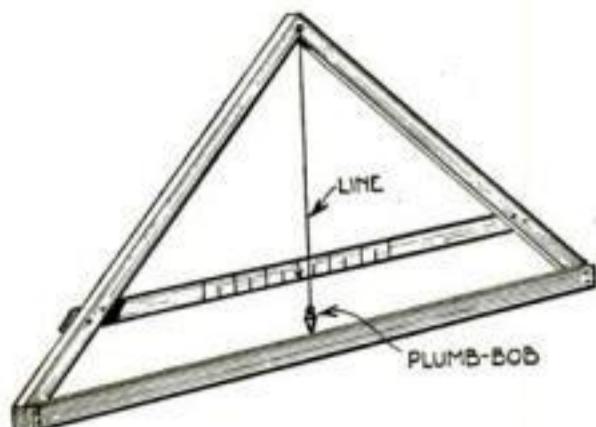
Try the remedy suggested here and it will stop the rattling

Before putting the nuts on the securing bolts, two heavy lock washers are placed under them and the nuts drawn tight and cotter-pinned. The leather holds sufficient oil to keep the ball lubricated while the spring of the lock-washers holds the cap snug against the ball, eliminating the rattle.

The writer has used this method for many years with perfect results, obtaining good tight steering connections and complete elimination of rattling noises.

Simple and Accurate Is This Homemade Plumb-Level

NOT every handy man has a spirit level, but a very good substitute for the carpenter's level when laying out the foundation for an outbuilding, or of the engineer's level when ditching for drainage



For rough work this plumb-level may safely be used in place of a spirit-level

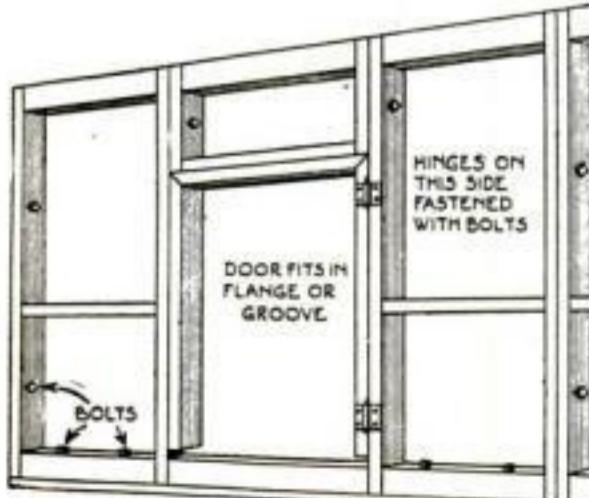
or irrigation, is the "triangle," a device made of four pieces of straight lumber and a plumb-line.

As shown in the illustration, the pieces are nailed together in the form of the letter A with the line suspended from the top. When completed, set the triangle with the lower side on an approximately level surface, and mark where the line strikes on the middle piece; reverse and note second position. If the marks are not the same, the surface is not level, and a mark midway between the two will mark the position of the line when the triangle is perfectly level. With a fine line as accurate leveling can be done with the triangle as with a spirit level.

The bottom side of the triangle should be perfectly straight, and it should be held so that the plumb-line swings clear. If graduations are made on the middle bar each side of the central mark, any desired grade can be run by letting the plumb-line swing opposite the required mark.

Porch-Screens Put Up without Using Nails

HOUSEOWNERS who contemplate screening their porches to keep out flies, mosquitos, and other insect pests may profit from the suggestions contained in this article. Four years ago I decided to put up screens around my porch. Previous experience had taught me that the frames of the screens fastened together with nails invariably split when the nails are taken out in the autumn. I also had learned that



Porch-screens should not be nailed, but should be fastened together with bolts. They are easier to put up and take down

nailed screens soon become loose and that screws, though satisfactory at first, lose their power to hold after they have been removed. I therefore decided to use bolts and the result was that after four years my screens were as good as they were when originally put up.

Along the ceiling of the porch I nailed bevelled molding-strips. Between these the screens were slid. These moldings were left intact when the screens were taken down. No moldings were used on the floor. The bottom pieces of the frame were fastened to the flooring with screw-bolts.

After the screen-frames were set up, they were bolted together tightly with screw-bolts. Washers were placed under the heads and the nuts of the bolts and the screens fitted so closely that no insect got through the cracks.

For the door-frame I used boards double the width of the frame lumber. The hinges were fastened permanently with screws to the door, while screw-bolts were used to fasten them to the door-frame.

He Converted a Fruit-Jar into a Bucket

FRUIT-JARS are useful for many purposes, but are extremely tiresome to carry a considerable distance, because they have no handle and are too bulky for the pocket. A glass jar like that shown in the illustration may easily be changed to a bucket with the aid of a piece of soft wire and a suitable carrying handle, such as is used for carrying parcels.

Twist two ears or loops in the wire at such distance from each other that one will be exactly opposite the other when the wire is placed around the neck of the jar. The free ends of the wire are twisted together until the wire firmly grips the neck. The twisted ends should be bent over against the neck of the jar.

The hooks of the handle should be slipped through the loops or ears of the wire and bent to prevent them from slipping out.—JESSE L. BLICKENSTAFF.

Testing the Power of Your Binoculars

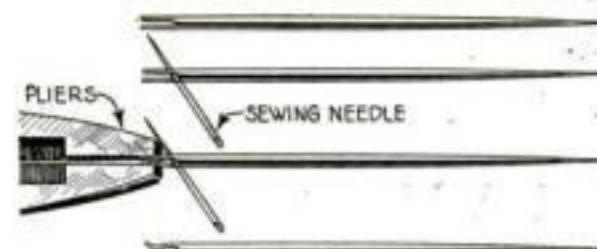
WHEN buying a pair of binoculars you often want to make a test for power and clearness.

Close to and above the middle star in the Great Bear (*Ursa Major*), may be seen with the naked eye another small star. With binoculars of power six, you should be able to distinguish, between them, another star of magnitude eight.

A Darning-Needle that Threads Itself

SELF-THREADING darning-needles may be made in a few minutes from those of ordinary type, by the following simple method:

Hold the eye end of a needle in the



This darning needle is easily threaded. The yarn is slipped in the open eye and is held by the spring.

flame of a match or candle for a few seconds so that the steel is softened, and then file off the end, leaving the forks as long as possible.

Now insert the point of a small sewing-needle in the fork, close to the shank, and close the prongs until an eye is formed, with the ends bent outward.

After the desired shape is obtained, place the needle in the flame again, and then plunge it into a cupful of cold water. Repeat this hardening process several times, and the eyelet will possess sufficient spring to receive the wool strands when slipped into the open end of the needle.

Make an Ash-Tray from a Coconut Shell

A VERY serviceable ash-tray may be made from half of a coconut shell. A wooden base is fitted to it by first drilling a hole through the bottom of the shell and through the center of the wooden base. A bolt is passed down through the base and the bottom of the shell. This is a very attractive ash-tray and costs nothing to make.—G. BEN-DER.



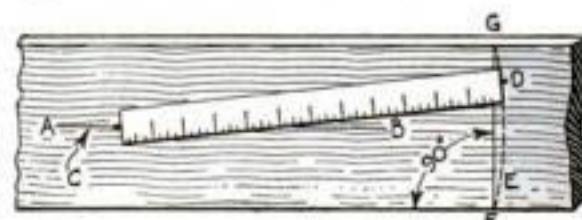
Part of a spool forms the base of this coconut ash-tray

Can You Square with an Ordinary Rule?

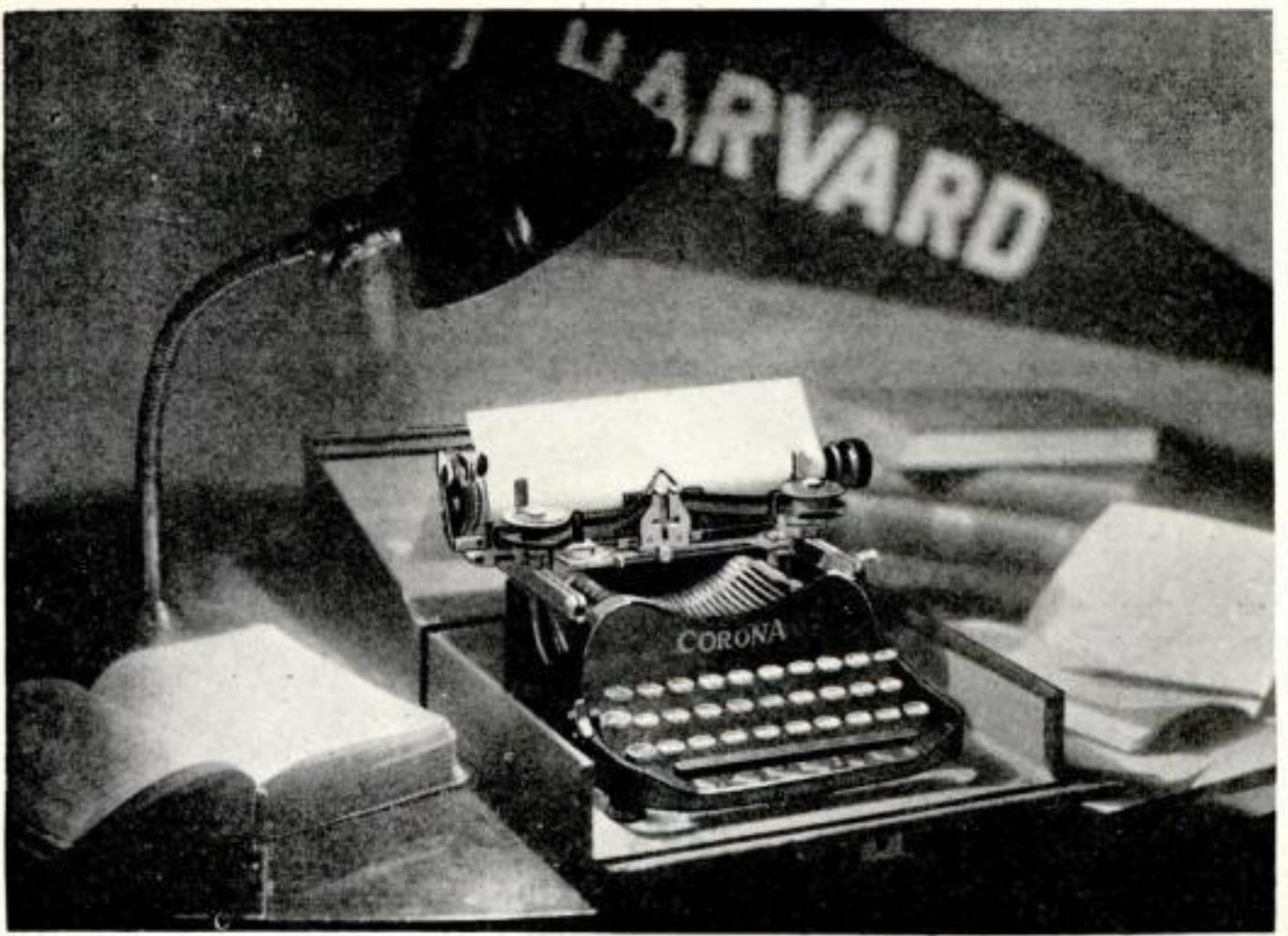
CAN you square a board correctly with an ordinary rule? It is well to know how to accomplish the task.

First draw a line partway along the center of the board as at A'B'. Next, lay the scale at the center point C; place a pencil at D and describe the arc E.

Join the two points F and G, and the line you get will be exactly square with the edges of the board.—J. H. MOORE.



Here is shown a method of squaring a board with a foot-rule if you have no carpenter's square



Corona is making school work easier!

GO into any college dormitory this fall—and you will find students clicking merrily away on Corona.

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If you are sending a boy or girl to school or college this fall, Corona is a most important part of the school outfit. If you yourself are a student, don't go through another term without Corona.

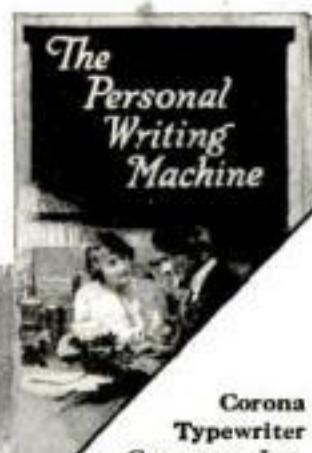
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